Motor Drive Requirements of Steel Rolling Mills—*Alternating Current Service for a Large Office Building and the regular departments devoted to engineering, operating and commercial topics.*

Electrical World

New York, September 30, 1916 McGraw Publishing Co., Inc. Vol. 68, No. 14 10c a copy

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Weston Portable Instrument Transformers are described in Bulletin 2001

Model 341
A. C. and D. C. Portable Electrodynamometer
VOLTMETER

Model 310
Single-Phase and Direct Current Portable Electrodynamometer
WATTMETER

Model 370
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Electrical World

The consolidation of ELECTRICAL WORLD AND ENGINEER and AMERICAN ELECTRICIAN.
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Marking Engineering Progress

AGAIN our imagination is fired with the possibilities of the future, by the review of solid electrical engineering accomplishment, which is recorded in the anniversary number of our English contemporary, the London *Electrician*. September 15 marked the 2000th issue of that "oldest illustrated journal of electrical engineering, industry, science and finance." Its first number was issued in November, 1861, as a journal for telegraphers, suggesting to our own readers the early history of the properties now consolidated in the ELECTRICAL WORLD. With this splendid number of the *Electrician* before us we have gone back into our own files and reviewed again the history of American electrical engineering practice that has been reflected in the forty years and more of our own electrical journals. In certain lines our practice has been widely divergent. The American electrical industry has gradually been very highly organized in forty years. Conditions have brought about what seems to us to be a much wider utilization of electrical energy in this country. Specialization, standardization and centralization have marked American practice. There is greater uniformity in the practice of widely separate localities in America than in England. But in the broad development of the industry in science and applied engineering, advance on one side of the water is closely associated with progress on the other. All this and much more is reflected in the special articles on electrical design, the generation, distribution and control of electrical energy and the special applications in railway, power and lighting in the special number of our contemporary.

American Colored Glasses

DR. H. P. GAGE'S paper on colored glasses presented at the Illuminating Engineering Society convention is a very welcome addition to the knowledge of a somewhat intricate subject. Many reports have been published concerning colored glasses for protective spectacles and other uses, but for the most part the glasses described have been of foreign origin, many of them not now attainable, and few of any particular merit. It is gratifying to know that we are now making in America a wide range of glasses for signals, spectacles and color modifying purposes generally, which compare very favorably with anything which has ever turned up from the makers abroad, and give a sufficiently wide range of choice to meet admirably most requirements. Dr. Gage's work has been most thorough and scientific, and his paper will stand as the fundamental starting point in the consideration of the making of American colored glasses. A cursory examination shows that considerable improvements have been made in the transmission coefficients of some of the signal glasses, that material headway has been found possible in the production of glasses tending to correct the color of artificial illuminants toward a daylight value, and that protective glasses for spectacles of various kinds are in at least as satisfactory a state in this country as they ever have been abroad. Blue, yellow, amber and red glasses are obtainable in a wide variety of tints and all with good transmission for the respective rays.

There is a particular lack, however, of glasses which absorb sharply the red end of the spectrum, leaving the rest nearly intact. It is equally difficult to get a glass which thoroughly absorbs the infra-red. Sir William Crooke's glass, which owes its properties chiefly to didymium, perhaps as nearly fills the infra-red requirement as is feasible, since didymium has a heavy absorption band in the near infra-red, as well as the familiar one in the yellow which gives the pinkish tinge to this glass. Almost any glass except the lightest crown will absorb all of the ultra-violet that is reasonably suspected of being harmful, but most glasses classed as protective are somewhat noticeably colored. The Crooke's glass and that described by Dr. Gage under the name of noviol perhaps show the least color for a rather complete suppression of the ultra-violet, both of them comparing very favorably with the best of the much exploited German glasses for this purpose, the noviol being remarkable for a peculiarly hard and clean cut-off of the blue end of the spectrum. A glass which will cut off the red end with similar neatness would be a valuable addition to the technical resources of the illuminating engineer.

Promoting the Electric Vehicle

IF the possibility of developing the electric vehicle and adding it to the line of successful and widening applications of electricity were not fundamentally sound it must have died long since. From time to time we have recorded and pointed out opportunities that exist for the wider use of the electrically propelled vehicle. Each time a group of enthusiasts has helped to carry the banner forward and then the advance has marked time. The ELECTRICAL WORLD believes in the electric vehicle and has urged constantly the reasons why it should be backed by the active interest of electrical men. The time seems ripe again to push forward, and that

the whole situation may be thoroughly surveyed we shall publish a group of articles for which we have been gathering material for some months.

There are three groups in the industry responsible for the development of the electric vehicle—the manufacturers of cars, the manufacturers of batteries, and the central stations. Of these groups the central station has a double duty which has often fogged the issue. It is both a customer for the manufacturer and a purveyor of energy for charging. Thus it must consider the vehicle in the light of a business man, first estimating the value to be received directly from its use, and second as a promoter of an electrical enterprise that may be expected immediately or shortly to produce a revenue. It cannot be expected to act if these relations are not clearly recognized.

We are presenting in this issue the first of two articles on the uses to which the central stations have put motor vehicles of all kinds as a business proposition. In this first article the actual uses of both gas and electric trucks for heavy work are described. In a second article the possibilities of motor vehicles for light work will be taken up. As a business proposition the electric truck and the gasoline truck each has its place in the central station field as well as in any industrial field which presents a wide variety of haulage and traffic conditions. We have learned that replacing the horse means revolutionizing our conception of how hauling should be done, and that the proper way to sell motor vehicles is to sell traffic engineering. A corollary to this fact is the sound reason that electric vehicles, properly recommended and handled with no less care than that which is given to gasoline trucks, are cold, money-saving machines.

In the passenger-carrying field the electric vehicle is getting deserved consideration. Here again the central station has the double relation to it, first, as an income producer from battery charging; second, as a promoter of electrical applications in the community. The electric car for general, local utility work is handicapped by traditional conceptions of what it would do earlier in its development and what it can do now. The manufacturer, in our opinion, is to blame for this. The central stations have had difficulties which are remembered. On the other hand, it is not fair to assume that by putting a battery and a motor on a cheap chassis, the result will be a satisfactory car. Manufacturers have put money into machines and equipment for standardizing parts and are now in a position to turn out cars in quantities.

These different phases of promoting the electric vehicle will be put into articles in future issues. A particularly fortunate circumstance in the renewed interest in the promotion of the electric vehicle is the opportunity which is offered by the committee on co-operation between central stations and manufacturers of the Electric Vehicle Section of the National Electric Light Association to secure frank interchange of opinions between central station men and manufacturers at the same sitting. The electric vehicle properly built and properly sold can do the work.

Steel Rolling Mills Drives

IT is characteristic of steel rolling mills that their load factor is relatively small; *i.e.*, that the average load which they carry is much less than the maximum load. Moreover, the times of maximum load are of only a few seconds' duration; corresponding to those intervals during which the bars or billets are passing through the rolls.

While it is possible to install a roll-driving motor which shall be able to develop the maximum required power without exceeding its normal rated current from the supply mains; yet such a motor would ordinarily be operating on the average at a small percentage of its rated output, and would not be economically used. A flywheel connected with the motor system, so as to absorb energy steadily during intermissions and to release this energy rapidly during the intervals of load, may greatly improve the economy, compactness and effectiveness of the drive. There are, however, limits to the application of the flywheel principle. Excessively large flywheels may be both objectionable in service and uneconomical in plant expenditure. In the design of an electric drive for steel rolls, there is a fairly definite economic limit to the relative sizes of motor and flywheel to be used, under an assigned set of factory conditions.

The article by W. Knight, which we publish this week, is directed to facilitating the computations involved in the design of rolling mill motor drives with auxiliary flywheels. The formula employed introduces a certain exponential. Ordinarily, this calls for solution by logarithms, log-log slide rules, or other roundabout methods. By plotting the graphs of a suitable number of exponentials on semilog paper, these graphs take the form of straight lines, and permit of rapid solution of the exponential by direct inspection. This is another example of the serviceability of semilog and log papers to the engineer. In log paper, the rectangular co-ordinates in both x and y are spaced according to the scale of the slide rule. In semilog paper, one coordinate is ruled to uniform scale in the ordinary way, and the other is ruled to slide-rule scale. In this case, by the use of the semilog chart, the design computations are greatly abridged.

Earth Connections for Telephone Exchanges

IN our "Digest" this week reference is made to a recent article by W. H. Grinsted, in the London *Electrician,* dealing with earth connections for telephone exchanges. It is pointed out that the ordinary exchange employs two separate grounds; namely, (1) a water-pipe ground for its lightning arresters, machine frames and bases generally, and (2) a buried copper in coke ground for the central common battery, and which carries the common battery operating currents. It is suggested that it would be better to reverse the practice, and use a special plate arrester ground, while grounding the battery on the leaden sheaths of the incoming cables. This is a detail of operating practice upon

which opinions are likely to differ; but so long as the water-pipes are sufficiently protected from possible electrolytic erosion, there are some who maintain that it is better to have earth to earth, and connect all grounds together for all purposes into one united ground system.

The article points out that, contrary to the practice in electric railway systems, it is customary in telephone exchanges to ground the positive pole of the common battery, so as to keep the wiring and lines at a negative potential. This tends to cause the generation of hydrogen at any faulty point in wires or windings that may take in moisture; whereas, if these were kept at a positive potential, the tendency would be for them to oxidize and corrode in the presence of water. With some of the fine insulated wires employed in telephonic windings, a relatively small amount of corrosion may destroy the continuity of the wire.

A Study of Brightness

THE psychology of illumination is so intricate a problem that most physical investigators shun it and most psychologists have to specialize so deeply as to find difficulty in approaching the matter from its physical aspect. Those interested in the ultimate analysis of visual matters will find pleasure in the valuable study of apparent brightness by L. T. Troland presented at the recent Illuminating Engineering Society's convention. Mr. Troland attacks particularly the problem of apparent luminosity both with respect to ordinary conditions and those which specially involve color sensation. His point of departure from the ordinary process of such investigation is first in dealing with a subject much neglected, the intensity of the actual retinal image; and second, in separating experimentally the visual functions of the fovea, which consists of cones alone, from the general vision in the region of intermingled rods and cones and the peripheral region of rods alone. We must good naturedly protest against the introduction of still another new term as a unit of retinal illumination, at a time when it is all that can be practically accomplished to get the simplest sort of terminology for luminous quantities into anything like general use. However, the idea expressed is important enough to stand the burden of a new word provided the author does not do it again.

The most interesting conclusion reached from a theoretical standpoint has to do with the investigation of pure cone vision with respect to the luminosity sensation. Ordinarily cones are supposed to be highly specialized for color vision, while the sensation of luminosity aside from color resides in the rods associated with the presence of the visual purple which is believed to act in some ways as a chemical sensitizer. Now by investigating a very small area, so small as to be concerned only with foveal vision, Mr. Troland finds clear indications of an extremely symmetrical visibility curve for the cones, indicating that even in cone vision luminosity as such is probably independent of the wave length of the stimulus, and is very likely due to a single photochemical process in the retina rather than to the summation of separate color processes. This does not make negative the probable existence of a complexly organized color sense, but merely shows that the luminosity value ascribed to the cones is much more like the rod luminosity than has generally been admitted and depends perhaps on the same photochemical process. These properties of the cones with respect to luminosity hold only within the proper range of cone vision which reaches its normal at a point much higher than that which characterizes rod vision.

Mr. Troland also finds that with a field so small as to deal only with the pure cone vision of the fovea the Purkinje and allied phenomena are greatly modified or disappear. The subject is a very intricate one and the experimentation is difficult; but all the results work toward showing an actual unity in the visual functions of the eye in spite of the differentiation between the precise uses of rods and cones. The facts here seem to point in something of the same direction as recent experiments of Dr. Edridge-Green, who has long held that the stimulus of the visual purple ultimately involves the fovea, so that the photochemical stimulus is in kind the same throughout, although varying in degree from the regions rich in visual purple to those normally very poor in it. With all this the theory of color sensation is still far from definite form. Sooner or later it must be co-ordinated with the facts regarding simple luminosity.

The Coming Issues

NEXT week, in the public relations number of the ELECTRICAL WORLD for Oct. 7, the first issue of the month, among other discussions of public policy and broad commercial topics, there will appear an interesting and practical article entitled "Graphical Analysis of Managerial Problems," in which Edwin D. Dreyfus will treat of executive subjects from the standpoint of the engineer. Another leading article in the same issue will describe the features of a 5000-amp.-hr. storage battery installed by the Winnipeg (Man.) Electric Railway Company for railway service. Arrangements provided by this Canadian company to serve a large cement plant load will also be described. The second issue of the month, to appear under date of Oct. 14, will be the station operating number, which is regularly devoted to practical engineering subjects and to topics and problems pertaining to station and operating practice. A leading article will take up the operating aspects of a large Eastern transmission network, and in addition to other features there will be the usual departments on technical, operating and commercial topics. The fourth issue of the new monthly magazine ELECTRICAL MERCHANDISING, to appear Oct. 15, will, among many other articles and ideas for the electrical man who sells, contain a forecast of plans for America's Electrical Week, Dec. 2 to 9, pointing out how each electrical dealer, contractor, manufacturer, jobber and central station man can take the fullest advantage of the great buying movement in the industry which will culminate during America's Electrical Week.

Chronicle of Events of the Industry and of Important Movements in the Field

NEWS OF THE WEEK

Reports of Conventions and Meetings of Electrical Associations and Societies

NEW ENGLAND CONTRACTORS MEET

Hartford Convention Discusses Licensing, Uniform Inspection and Account Keeping

A large and enthusiastic convention of New England Electrical Contractors opened at Hartford, Conn., on the evening of Sept. 26 with an informal "Better Acquaintance" dinner at the Hotel Bond Annex, followed by visits to an electrical exhibition at Foot Guard Hall. Business sessions opened on Wednesday morning with announcements by L. L. Gaillard, Waterbury, chairman, and the program included addresses by Hon. Frank A. Hagarty, Mayor of Hartford; Robley S. Stearns, New Orleans, La., president of the National Electrical Contractors' Association, and W. K. Tuohey, Springfield, Mass., past-president, Massachusetts Electrical Contractors' Association. A paper by J. E. Wilson, Boston, Mass., on "The Licensing of Electrical Contractors, with Reference in particular to the Massachusetts Law," concluded the morning program.

"The Uniform Inspection of Electrical Installations for the New England States" was the general subject of the afternoon session, papers on this topic by A. J. Hixon, Boston; Ralph Sweetland, engineer-in-charge, New England Insurance Exchange, Boston; and C. E. Bruen, Suburban Fire Insurance Exchange, New York City, being scheduled. An informal banquet at the Hotel Bond closed the day.

Committee reports filled the Thursday morning session, those presented covering "Trade Relations," by W. F. Abely, chairman, Boston; report of legislative committees, Massachusetts, Connecticut and Rhode Island Associations, and the reports of the Massachusetts and Connecticut conference boards with central stations.

During the afternoon a session for electrical contractors only was held, at which a paper by Percy Rothwell, expert accountant, Hartford, on "Account Keeping for Electrical Contractors," was the principal feature of the program. Adjournment followed a business session at the close of the consideration of the foregoing topic. More than fifty exhibitors of electrical appliances and apparatus occupied space at the armory. The streets of the downtown district were festooned with incandescent lamps and bunting in honor of the gathering.

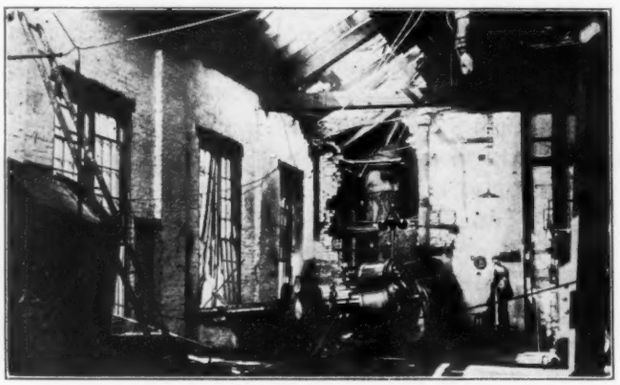
Convention of Colorado Electric Association

A noteworthy feature of the fourteenth annual convention of the Colorado Electric Light, Power & Railway Association at Glenwood Springs, Sept. 21 to 23, was the active participation of representatives of the public utilities commission of the State of Colorado in the convention program. M. H. Aylesworth, chairman of the commission; F. J. Rankin, its mechanical and electrical engineer, and F. W. Herbert, its chief statistician, all delivered papers. Moreover, throughout the meetings the desire was manifested by central station men to learn the views of the commission on many central station problems. The representatives of the commission freely discussed and argued the topics brought up at the convention. All discussions indicated the earnest desire of the utilities and the commission to co-operate.

At one of the business sessions the plan of assessing association dues was changed so that now each member company is charged according to the population it serves. Officers for the ensuing year were elected as follows: President, John A. Clay, general manager of the Western Colorado Power Company of Montrose; vice-president, L. P. Hammond, vice-president Colorado Power Company of Denver; secretary-treasurer, Thomas F. Kennedy, Denver Gas & Electric Light Company, and executive committee, F. P. Wood of Trinidad, W. F. Raber of Pueblo and J. J. Cooper and W. C. Sterne, both of Denver.

Competing Central Stations Co-operate to Restore Service

A flywheel explosion in the plant of the Mansfield (Ohio) Railway, Light & Power Company, Sept. 22, completely wrecked a 250-hp. engine, considerably damaged the power house, other engines and adjacent pole lines, killed the night engineer and interrupted the company's lighting, power and street railway service. The accident practically left the company, which is one of two central stations in the city, without plant facilities to supply service and without enough experienced men to rehabilitate speedily the generating and line equipment. The accident occurred at 10.18 p. m.



WRECKED PLANT AT MANSFIELD, OHIO

Upon surveying the situation, A. V. Wynne, general superintendent of the Mansfield Electric Light & Power Company, the competing company, called out his entire construction and spare operating force. With the consent of S. A. Foltz, manager of the wrecked plant, they set to work on the ruins at 11 p. m.

In speaking of the hurried reconstruction, Mr. Wynne said: "Owing to the fact that we have a great deal of construction under way, we were able to muster about three times as many men as the other company. Quite naturally our men were less excited than theirs, so we took the initiative and started the work. By 2 a. m. we had cleared away enough of the wreckage to see that it would be necessary to build a new crib to replace the one which had been struck by a 4-ft. section of the flywheel rim. Accordingly we took enough 16-ft. arms from our own crib to build one for them and by 5 a. m. had juice on the lines. Everything then

looked fine, but after I had sent our men home, it developed that it would be dangerous to operate one of their larger engines. Then our force was called out again to run temporary leads from our lines to their switchboard. On Saturday night, Sunday and Sunday night, we carried 200 kw. of their load on these lines. This tided them over the emergency.

"Since the accident we have received many compliments from the public on our policy of helping the customers of the other company get service in an emergency."

PREVENTION OF UTILITY STRIKES

Merchants' Association of New York Suggests Means for Safeguarding All Public Utility Service from Menace of Labor Disputes

The board of directors of the Merchants' Association of New York at a meeting held on Sept. 21 approved the report of its committee on public utilities and law and the resolutions and preambles therein contained. The adoption of the following preambles and resolution was recommended to the Chamber of Commerce of the United States:

Whereas, The functions of railroads and other public utilities are exercised only by virtue of public authority, delegated to the corporations solely to provide for imperative public needs; whereby such utilities become public agencies, subject to such control and regulation by law as may be required in the public interest; and

Whereas, The public welfare requires that the operation of public utilities be continuous and unimpeded; and

Whereas, Continuous and unimpeded operation of public utilities cannot be maintained if the employees of public service corporations are free to quit their employment at an indeterminate time; now, therefore, be it

Resolved, That the tenure of service of employees of public service corporations, particularly of transportation corporations, should be regulated by law in such manner that each person who voluntarily elects to enter such employment shall, as a condition of such employment, be legally obligated by contract to continue therein for a specified term, during which term he may not lawfully quit that employment nor the corporation lawfully discharge him from its service, except as provided by such contract; and that such contract should provide adequate penalties for violation of its terms by either party.

According to the committee any plan to regulate the relations between public service corporations and their employees should be based on recognition of the following fundamental facts outlined by Henry R. Towne, a former president of the chamber:

1. The company enjoys a partial or complete monopoly, granted by the State in order to secure for the people the service which the company undertakes to render.

2. In return the company is required to render that service in conformity with statutory enactments, and under the regulation of a State (or national) board or commission.

3. In order to perform that service the company must act through agents or employees, and it is equally necessary and proper that these should be governed by statute, and be subject to regulation by such board or commission. Heretofore this has not been done, or only in a slight degree.

4. There are thus three parties concerned, viz.:

(*a*) The people; that is, the State.

(*b*) The corporation, including its owners, the stockholders.

(*c*) The employees.

The plan should aim to recognize and safeguard equally the rights and interests of each and all of these three parties.

5. To do this, it should provide:

(*a*) That the company shall give adequate service, and shall conform to the law and to the orders of the board or commission.

(*b*) That persons who voluntarily become employees shall conform to the laws and regulations, and shall not conspire to impair the service.

(*c*) That the two parties, the company and the employees, shall recognize and respect the paramount rights of the third party, the public, to adequate and uninterrupted service in return for the grant of the franchise under which the company operates and by virtue of which those who enter its service find employment.

Laws and regulations which are based on recognition of these facts and which are designed to accomplish these results are not merely proper and justifiable, but are logically called for to define and assure the rights of the companies and their stockholders, the rights of their vast number of employees, and, above all, the rights of the State, that is the people, which is the grantor of the public franchise which is the basis of the whole structure, the sole purpose of which is to obtain for the people the service stated in the franchise. Opposition to such reasonable laws and regulations would constitute a menace to the common weal.

To accomplish these ends there is needed legislation, State or national, or both, which would authorize and require, among other things, a contractual relationship between each public service corporation and each of its employees embodying the following provisions, viz.:

1. An enlistment or enrollment contract for a stated term. After a probationary period, in the case of a new employee; removable by mutual agreement, at the end of term, in the case of an old employee.

2. A "service record" of each employee, to be kept.

3. Preference in promotions, and in retention in the service, to be based on such records.

4. Penalties for violation of the contract by either party, to consist of cash fines.

5. Fines against company to be collectible from a fund created by the company and vested in a trustee.

6. Fines against an employee to be collectible from a fund created by the company's retaining, say, 20 per cent of his wages until the fund equals two weeks' wages (would require ten weeks), the company to pay interest at 5 per cent on this fund, and to repay it when the employee leaves the service as prescribed in the contract, or dies. The fund to be in the custody of a trustee.

7. Schedule of fines to be fixed by law and stated in the contract.

8. Assessment of fines to be determinable,

(*a*) By mutual consent, duly recorded.

(*b*) By joint board of award, duly appointed.

(c) By public service commission on appeal.

(*d*) By legal process.

9. The company to have the right to terminate the contract,

(*a*) Because of misconduct by the employee. "Misconduct" to be defined by law and in the contract, and also the fines attaching thereto.

(*b*) Because of slack business or excess of help. In this case the employee to receive either thirty days' notice, or two weeks' pay and immediate release.

(*c*) Because of disability or superannuation of employee, on stated notice, subject to such pension provisions, if any, as may exist.

10. The employee to have the right to terminate the contract,

(*a*) Because of valid family or personal necessity.

In which case, honorable discharge, without penalty.

(*b*) Because of sickness or of unfavorable effect on health.

(*c*) For cause not stated, upon fair notice, say thirty days, without penalty if with the company's consent; otherwise subject to fine, as provided by law and stated in the contract.

11. Violation of the contract by the company, if duly established, to subject it to stated fines, payable to the employee, from the fund vested in a trustee.

12. Violation by the employee, if duly established, to subject him to fines collectible by the company from the fund held for that purpose by a trustee; and also, under specified conditions, to forfeiture of wages earned but not yet paid.

13. The company to recognize the right of the employee to membership in any lawful organization, and not to discriminate against him on such account.

14. The employee to respect the right of the public to uninterrupted service, and not to combine with others to cause its interruption.

15. The employee to have the right, alone or in combination with others, to request concessions, in wages, hours of work, or conditions of service, from the company, and the company to give prompt and fair consideration to all such requests when properly presented, and not to discriminate against any employee because of participation therein.

16. The employee to have the right of appeal, from acts or decisions of the company, to a "joint board of award," constituted under the law by joint action of the company and its employees, as a board of arbitration.

17. Both the company and its employees to have the right of appeal from the rulings of the "joint board" to an appropriate federal or State commission, whose decisions shall be conclusive and binding, unless and until reversed by a court decision.

18. During the term of any contract between the company and an employee the discharge of the employee by the company (except as provided in No. 9 above), or the cessation of service by the employee (except as provided in No. 10 above), to be constituted an offense at law, and to be punishable as the law may prescribe.

City of Chicago Rejects Cable Bids

Under the date of Aug. 19, 1916, the City of Chicago, Ill., advertised for bids on cable for a part of its lighting system extension on the Northwest Side, comprising 6000 100-cp. lamps. The advertisement called for bids on all or any part of 2,000,000 ft. of No. 8600-volt, varnished-cloth, lead-covered, steel-taped cable, and on all or any part of 250,000 ft. of No. 8, 5000-volt, varnished-cloth, lead-covered, steel-taped cable. Delivery was asked for on or before Nov. 15, 1916, at any rate it could be made. Among the bids received only one offered any cable that met the specifications as to delivery. This one manufacturer offered a total of 145,000 ft. of the 600-volt cable at a price of $16.10 per 100 ft.

As the result of this high cost and slow delivery condition the City of Chicago has rejected all of the bids and expects to readvertise for the cable. William G. Kieth, commissioner of gas and electricity for the city, said that other construction material which can be bought now will be bought, and that the lighting system will be brought as nearly to completion as is possible without the cable. Later, when the cable can be purchased at a figure the city can afford to pay, it will be purchased and the job will be completed.

N. E. L. A. Committee Meetings

During the month of October important committee meetings will be held by the National Electric Light Association. Atlantic City has been selected as the place for a number of these, while the others will be held at headquarters in New York.

On Oct. 11 the executive committee of the Technical and Hydroelectric Section, of which R. J. McClelland of New York is chairman, will meet at the Traymore Hotel, Atlantic City. During the same day and at the same hotel the power sales bureau of the Commercial Section, George H. Jones of Chicago, chairman, will meet and the probabilities are that the publication committee of the Commercial Section, F. D. Pembleton of Newark, chairman, and the committee on co-ordinate advertising and sales campaigns, Henry Harris of Pittsburgh, chairman, will also convene.

On Oct. 12 at the Hotel Traymore, Atlantic City, there will be a joint session of the executive committees of the Commercial Section, E. A. Edkins of Chicago, chairman, and the Technical and Hydroelectric Section. The membership committee and the committee on geographic sections will meet in New York on that day. The following day the executive committee of the national body will sit in New York and also the executive committee of the Electric Vehicle Section, E. S. Mansfield of Boston chairman. It is expected that the merchandising committee of the Commercial Section, of which J. V. Guilfoyle of New York is chairman, will also hold a session in New York on Oct. 13.

American Electrochemical Society Meeting

In conjunction with the second national exhibition of chemical industries held during the past week at the Grand Central Palace, New York City, the fall meeting of the American Electrochemical Society opened on Wednesday last, continuing through to Saturday. With Dr. C. G. Fink, chairman of the New York section, presiding, the meeting opened at 11.30 o'clock on Sept. 29 in the lecture room of the exposition. A. Nagdvoort, one of the managers of the exposition, delivered the address of welcome. The presidential address was read by Dr. Mathews in the absence of President F. A. J. Fitzgerald of Niagara Falls, N. Y., who is ill.

The technical program was held on Thursday and Friday, at which sessions the following papers were scheduled to be read:

"The Protection of Iron by Electroplating," by O. P. Watts and P. L. DeVerter; "Atmospheric Corrosion of Commercial Sheet Iron," by E. A. and L. T. Richardson; "The Electrolytic Recovery of Lead from Brine Leaches," by O. C. Ralston and C. E. Sims; "Electrolytic Zinc Dust," by H. J. Morgan and O. C. Ralston; "Electrolytic Behavior of Tungsten," by W. E. Koerner; "Electrolysis of Vanadium Salts," by S. Fischer; "The Electrodeposition of Nickel," by L. D. Hammond; "Current Efficiencies in Nickel Plating Baths with Rotating Cathodes," by F. C. Mathers and E. G. Sturdevant; "Deposition of Copper in Electrotyping Baths," by W. Blum; "Characteristics of Small Dry Cells," by C. F. Burgess; "Effect of Temperature on the Performance of the Edison Storage Battery," by L. C. Turnock; "High Temperature Heat Developed During Electrolysis," by Carl Hering; "The Possibilities of Developing Super-refractory Materials for Incandescent Lighting," by F. A. Fahrenwald; "Composition of the Ionization Currents Due to Equal Quantities of Radium Emanation," by H. Schlundt; T. H. Leaming and Julius Underwood; "A New Method for the Study of Silver-Peroxynitrate," by M. J. Brown; "The Vosmear Phenomenon,"

by W. C. Moore; "The Equilibrium Between Bromine and Potassium Bromide Solutions at Zero Degree" by Grinell Jones and M. L. Hartmann.

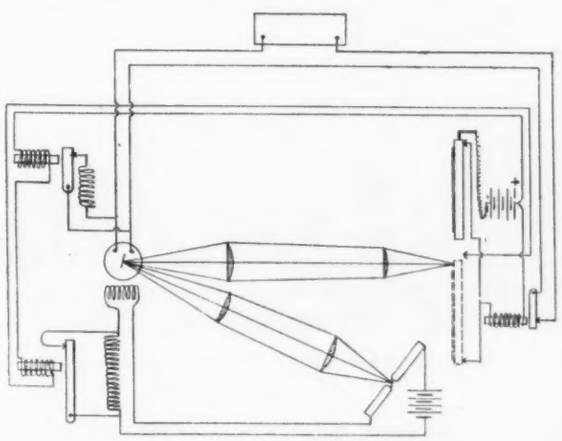
In the presidential address reasons were given for the present state of development or non-development of the industry. It was stated:

"It is well worth while studying those subjects in which we are not or have not been in the front rank in order to determine why this is so. Thus a study of the development of the use of the electric furnace for the manufacture of steel seems to show that special conditions in Europe tended to stimulate the development there and that it was actually to our advantage that the pioneer work should be done there rather than here, so that we have no cause to regret that while the pioneer work in this branch was being done in Europe we were busy in other directions.

"On the other hand, the study of the development of electrochemical methods of nitrogen fixation show a different reason for our backward position. Those not conversant with electrochemical history are apt to believe that this is altogether a foreign development, never having heard of the work of Bradley and Lovejoy at Niagara Falls more than twelve years ago. Here, then, we had a remarkable development that was arrested because of adverse environment. For in Europe when similar developments took place it was possible to obtain abundance of cheap electric power. When the question of 'National Preparedness' is in every one's mind we are asked what is to be done about the preparation of nitrates, for in this respect we are by no means ready, and the committee on public relations of the American Electrochemical Society in its report to the administration on this subject recommends 'a liberal water-power policy, as the question of the cost of power is vital to several of the processes.' "

Improvements in the Blondel Oscillograph

Professor André E. Blondel suggests a number of improvements for an oscillograph, directed in the main to increasing the projected light and deflective power, which is made the object of patent No. 1,196,837. Unfortunately the specification does not disclose much and the diagrams are referred to in only general terms. In order to obtain the greatest possible amount of light,



ARRANGEMENT OF OSCILLOGRAPH

the distance between the mirrors of the galvanometers and the photographic emulsion is reduced, which results in a reduction of the sensitiveness of deflection. To obviate the disadvantage in question, the following principle has therefore been suggested which consists in causing the recording apparatus to operate automatically mechanical or electric relays which short-circuit, only during the recording of the curves, shunts placed between the terminals of the galvanometers. By suddenly cutting off these shunts, it is possible to increase in any desired proportion the current temporarily passing through the galvanometers. This makes it possible to increase to a considerable extent the deflections even with an optical system of small length. The same contact can also be used for short-circuiting a portion of the resistance which feeds the arc lamp lighting the galvanometers, and in that way increasing also for a moment, during the time of recording, the strength of illumination. On the other hand, in order to enable zero lines for each curve to be traced, a cut-out relay controlled by electric contacts closed by the photographic recorder, either at the beginning or at the end of each record of curves is placed in series with each of the movable devices of the galvanometers.

Educational Committee of N. E. L. A. Planning Active Winter

About a year ago the committee on the education of salesmen of the National Electric Light Association issued a seventeen-lesson course on commercial engineering. This effort was the initial step in a comprehensive educational plan. No great amount of publicity has been given to the plan as a whole, but the committee, following the warm reception of its first effort, is now ready to announce its scheme for preparing courses covering all phases of the commercial side of the business besides a fundamental course on practical electricity.

For the latter course, the prospectus of which is now being sent to the printer, it is expected the demand will be large. It is intended for those who need a review course covering the fundamental principles of magnetism and electricity as well as for men in the employ of electrical firms who have not had the advantages of an electrical education. The courses planned to take up the various phases of the commercial side of the business will treat the following topics: Appliances, illumination, industrial heating, electric power, commercial management and merchandising. The last-named six courses will not be issued this year.

In promoting this commercial engineering course among the employees of electrical firms it has been the committee's practice to endeavor to reach the men through the responsible heads of the firms. The price of the course was made just high enough to cover the expense of issuing the course; that is, $12 cash or $16 if paid quarterly for the seventeen lessons. The course started with 600 subscribers, and in the year it has been operating has increased this number to 1200. It is the policy of about 85 per cent of the operating companies whose employees are interested in the course, to pay cash for the number of courses desired by the employees and then to collect from them in regular payments.

The chief difficulty the committee has encountered in the work has been the indifference of some operating officials. Quite frequently some individual employee has read of the course in the technical papers and has written the home office of the National Electric Light Association for information when circular matter covering the entire subject was at that time either in the office or in the wastebasket of the company's executive. Fred R. Jenkins, chairman of the committee on the education of salesmen, is now planning a campaign to drive home to indifferent officials the value of the commercial engineering and practical electricity courses.

WASHINGTON CONTRACTORS AND DEALERS CONVENE

First Annual Meeting of the Association Held in Seattle, Sept. 19 and 20—Program of the Various Sessions

With considerable enthusiasm and a marked tendency toward co-operation the Washington Association of Electrical Contractors and Dealers held its first annual convention at the Butler Hotel, Seattle, Wash., on Sept. 19 and 20. The meeting was opened by an address of welcome by V. S. McKenny, of Ne Page-McKenny Company, Seattle, president of the association. During the first day, the following program was presented:

"Washington Association of Electrical Contractors and Dealers: Its History, Purpose and Aim," by J. J. Agutter of J. J. Agutter & Company, Seattle; "Co-operation and Education," by C. C. Hillis, president of Pacific Coast Jobbers' Association; "Acceptances," by P. J. Aaron, representing the Seattle jobbers; "Southern California Association," by W. W. Graham, Los Angeles; "Tacoma Ordinance and State Legislation," by C. A. Young, representing the Tacoma contractors; "What the California Contractors' Association Has Accomplished in the Electrical Industry, from the Jobbers' Standpoint," by W. S. Berry, representing the California jobbers; "What the California Contractors' Association Has Accomplished in the Electrical Industry, from the Contractors' Standpoint," by F. J. Somers, president of California Association of Electrical Contractors and Dealers.

Albert H. Elliott, secretary of the Pacific Coast Jobbers' Association, delivered an address on the need of co-operation, education and confidence in the electrical industry, after which the speakers and guests met for lunch. The business meeting was called to order during the afternoon of the first day and a large volume of business was transacted. A resolution was unanimously carried that the association indorse and assist in America's Electrical Week, to be conducted by the Society of Electrical Development from Dec. 2 to 7, inclusive. The matter of the forming of a Western Conference Board with representatives from the Coast States, was approved, and the rules governing same were adopted. Several changes in the constitution and by-laws were submitted and accepted. During the afternoon Hugh L. Tinling, state representative at the California convention, delivered an address entitled "Impressions of California State Contractors' Meeting."

The following officers were elected to serve the ensuing year: President, V. S. McKenny, re-elected; vice-presidents: Seattle district, J. J. Agutter, W. M. Meacham and S. G. Hepler; Tacoma district, C. A. Young; Spokane district, Hugh L. Tinling and W. E. Chase; North Yakima, H. H. Gladston; Bellingham, M. Clark. The matter of forming a district for Walla Walla was referred to the executive committee.

At the banquet held at the Butler Hotel banquet room, seventy-nine persons attended. The principal speaker of the evening was Albert H. Elliott of San Francisco, on "Association Work." Five-minute talks were made by H. J. Gille of the Puget Sound Traction, Light & Power Company; W. M. Meacham of Meacham & Babcock, Seattle, and S. G. Hepler, Tacoma; H. D. Allison, Seattle, secretary, Washington association; J. W. Oberender, Portland, secretary Oregon association; Harry Sroufe, Portland; F. J. Somers, president California association; H. D. Reese, Carter Electric Company, Victoria, B. C.

The entire second day was taken up by an auto trip to the summit of Cascade Mountains, via Snoqualmie Falls and Lake Keechelus.

America's Electrical Week Committee Activities

The first meetings of many city committees, appointed in 268 towns and cities to manage local celebrations of "America's Electrical Week," were held during the week past. In most instances reported to the Society for Electrical Development all of the members of these committees were present. Organization work was completed and the active direction of the week's affairs set in motion.

The Coast cities particularly are off to an early start, as is evidenced by big meetings held in Seattle and Spokane. Seattle, at the first meeting of the local committee, decided to conduct an electrical show. M. C. Osborn, new president of the Northwestern Electric Light & Power Association, reports that Spokane will also have an electrical show, where special emphasis will be placed on moving exhibits. Reports from Aberdeen, northern Yakima, Hood River and Walla Walla show strong activities in behalf of the week.

KANSAS CITY JOVIANS DISCUSS A. E. W. PLANS

The Portland committee named financial and arrangement committees at their first meeting and decided to have representatives of all the Portland civic organizations meet with the committee at electrical lunches each day during the week. The Denver, Col., committee, which will this year handle the celebration throughout the State, has met and contributed details for the Statewide celebration. Mr. Hill, of the society's staff, reports meetings of the Birmingham, Ala., committee and the Charlottee commitee. The Pittsfield, Mass., committee has decided to hold an electrical fair.

PITTSFIELD JOVIANS AT ANNUAL OUTING WHEN PLANS WERE LAID FOR A. E. W. FAIR

The first fall meeting of the Kansas City Jovian Electric Club, held on Sept. 18, listened to H. W. Alexander, director of publicity of the Society for Electrical Development, Inc., outline the plans for America's Electrical Week. Otto H. Barth, representing the Kansas City Advertising Club, declared that the local club would do all it could toward the success of the week.

ELECTRICITY IN THE IRON AND STEEL INDUSTRY

Abstracts of Papers and Discussions at the Tenth Annual Convention of the Association of Iron and Steel Electrical Engineers

On Sept. 24, the last day of the convention of the Association of Iron and Steel Electrical Engineers at Chicago, interest centered around the paper by E. S. Jeffries of Hamilton, Ont., on "Operating Characteristics of an Electric Reversing Blooming Mill." The paper was important in that it contained production cost data of a character which heretofore steel mill men have always kept secret. While discussion did not bring out additional cost data it indicated that other steel mill engineers, as well as representatives of electrical manufacturers, welcomed the publication of such facts.

THE ENGINEERING OF ELECTRIC FURNACE INSTALLATION

George W. Richardson, Philadelphia, in his paper on "Mechanical and Electrical Operation of the Heroult Electric Arc Furnace," stated that single furnaces as large as 20 tons in capacity are now being erected. In speaking of the engineering of furnace installation he suggests two changes from existing practice; the transformers should be set on pedestals as near as possible to the furnace to shorten the secondary leads and thus decrease voltage drop; and the furnace busbars should be placed above the furnace masts so that they will not be surrounded by magnetic metal. The latter change would increase the power factor of the installation.

In discussing the paper R. T. Schentscher of South Chicago, Ill., said that if transformer designers will take into account the great reactance of the circuits between the transformers and the arcs of furnaces, they can design transformers for furnace installations with much less internal reactance. D. R. Rushmore of Schenectady took a somewhat different view, contending that high reactance is desirable as a protective factor.

A. T. Hinkley of Cleveland gave the results of tests made by the National Carbon Company on furnace electrode joints. With a current density of 35 amp. per square inch in the electrode, a screwed joint containing no joint compound produced an additional resistance equal to between 20 in. and 23 in. of electrode. Under the same conditions a screwed joint filled with a graphite and molasses compound produced an added resistance equal to from 12 in. to 15 in. of electrode. The best obtainable joint filler used in the same manner reduced the joint resistance to a value equal to between 2 in. and 6 in. of electrode. The first of these joints would not operate successfully; the second could be operated, but heated considerably; the third, however, could be operated without attaining red heat with the current density between 35 amp. and 40 amp. Mr. Hinkley said it seemed best not to allow the use of joint filler in layers thicker than $\frac{1}{8}$ in. In joints which do not fit as closely as this the compound is jarred out. Replying to a question he stated that electrodes when hot are not as strong as when cold by 15 per cent to 20 per cent.

A general spirit of optimism regarding future possibilities of the electric furnace in the steel industry was made evident by discussion of steel mill men. Walter Greenwood of Youngstown predicted that it would be possible to make railroad rails from electric steel at a price only $3 per ton higher than that charged for open-hearth steel. C. A. Menk, Newhall, Pa., related his experience in attempting to operate a combination gas and electric steel furnace. It was unsuccessful.

In his paper on "Control of Alternating-Current and Direct-Current Motors as Applied to Cranes," Paul Caldwell, Pittsburgh, Pa., presented a detailed dissertation on the merits of both systems amounting to forty-one printed pages. In summarizing he said: As far as mechanical construction and ruggedness are concerned both types of motors and controllers are equally reliable. Equally successful results can be obtained with both in the way of speed control, although not with the same degree of simplicity. One of the most important points in favor of the direct-current series motor is its speed characteristics, which are better adapted to this class of work and especially to the hoist motion. Generally speaking, alternating-current motors must be of larger power capacity than direct-current motors for crane service if an equal amount of work is to be performed. The successful development of dynamic braking for series motors is another important factor in favor of the direct-current type over the alternating-current motor. The torque characteristics of the direct-current motor on starting are superior to those of the alternating-current polyphase motor.

To provide the same refinement of speed control an alternating-current motor requires more points on the controller and a little additional care and practice on the part of the operator. The wiring required for direct-current motors is somewhat less than it would be for alternating-current motors. On the other hand, where direct-current motors are used it is necessary to either generate this form of current or to obtain it through a rotary or motor-generator set from an alternating-current source.

Where central station or purchased energy is used, as in some moderate-sized mills, the selection of electrical drive for the cranes would depend largely upon the following factors: First, the nature of connected load other than cranes; second, the percentage of crane load to total connected load; third, continuity of crane service. In a plant where alternating current can be successfully applied for main drives and other auxiliaries—for example, sheet or tin mills—and where the number of cranes is comparatively small, there is no advantage in resorting to a mixed system in order to use direct-current crane equipment.

The discussion of this paper centered around a system of control which would prevent dropping the load except when the hoisting cable breaks. The need for action of the standardization committee on control equipment was also commented on freely.

VALUE OF PORTABLE TOOL CIRCUIT BREAKER IS BROUGHT OUT

The paper on "Portable Electric Tools in the Iron and Steel Industry," by A. M. Andresen of Pittsburgh, set forth the fact that work in steel mills can be done with electric drills at about one-fifth the cost required for working with air drills. The relative efficiency of electric and pneumatic drills in the larger sizes is 75 per cent and 20 per cent respectively. The value of a circuit breaker developed for use with drills was also pointed out. This device is set to trip before a tool is jammed. The breaker can be reset by operating the switch at the tool handle. As a protection device for both equipment and operators it has proved effective.

F. D. Egan of Midland, Pa., and F. H. Woodhull of Coatesville, Pa., in the discussion both stated that electric drills are now being temporarily laid aside for pneumatic drills. This undesirable action, they said, is necessary since the high speed of the electric drill will not permit the use of any other than tool-steel bits. Tool steel is difficult to get at present and is very high in price. F. A. Wiley of South Chicago, Ill., said he found electric drills useful for drilling samples from

iron ingots that tumble from cars in the yards. These samples of shavings are analyzed to ascertain what grades of iron are in the lost ingots.

THE PRODUCTION OF SMALL DRY BATTERIES

Effect of Demand for Flashlight Batteries on Dry Cell Manufacture and Characteristics of These Small Units

In a paper read before the American Electrochemical Society at its meeting held in New York this week, C. F. Burgess called attention to the remarkable growth in the production of dry cells despite developments in the telephone field, signal work and gas engine ignition which have been predicted as factors to greatly reduce the demand for dry cells. The portable pocket flashlight was referred to as an important stimulant to dry battery manufacture. The author stated that if 50,000,000 represents the annual output of standard or so-called No. 6 dry cells in this country, this figure may be multiplied several times to represent the number of small dry cells used for flashlight and miscellaneous other purposes. High efficiency miniature tungsten lamps and improved quality of the battery have been important factors in stimulating the flashlight industry.

Considerable information was given in the paper on efficiency, output and other characteristics of small dry

TABLE I—RATING OF DRY CELLS FOR FLASHLIGHTS

Flashlight Bulbs	Volts	Amperes	Type of Battery to be Used	Ohms Resistance per Cell
Clear	2.7	0.35	2 cell—tubular type	3.84
	3.8	0.35	3 cell—tubular type	3.62
	2.9	0.35	2 cell—tubular type	4.14
	4.0	0.35	3 cell—tubular type	3.81
Opal back	2.5	0.35	2 cell—case type	3.57
	3.8	0.35	3 cell—case type	3.62
	2.5	0.25	2 cell—case type	5.00
			Average	3.94

cells based on a summary of tests made on about 4000 cells. The two most important characteristics by which the value of flashlight batteries may be determined, according to the author of the paper, are ability to furnish light over a period of time, or its capacity, and its ability to withstand deterioration when not in use, or its shelf life. Other characteristics of importance are voltage, recuperation, uniformity, size and cost. An accompanying table gives data on flashlight lamps as now standardized by manufacturers.

The data in the table indicates that about 4 ohms is close to the average resistance of the common sizes of lamps, and this is adopted as the standard. It is the resistance recommended by the committee on standard methods of testing dry cells, as outlined in the transactions of the American Electrochemical Society, Vol. 21, 1912. A voltage of 0.5 across the cell terminals when delivering current to the 4 ohms resistance is taken as the point where the current has fallen so low as to give a non-useful light. The standard method of capacity test consists in connecting an individual cell to a resistance coil of 4 ohms, and discharging continuously until this voltage drops to 0.5 volt. Most of the flashlight cells will drop to 0.5 volt during an eight-hour period. The larger cells will run beyond this, giving some chance to recuperate before the beginning of the following test period.

The author states that from long experience and a great many tests the best method of determining the deterioration going on within the cell is by measuring the short circuit flash which the cell gives when connected momentarily to an ammeter. A cell which gives an additional flash of 8 amp. when new may drop to 4 amp. after six months, and this indicates roughly a depreciation in capacity of 50 per cent. While the decrease in flash is not strictly proportional to the decrease in ampere-hour capacity, it is nevertheless a far

TABLE II—CAPACITY OR HOURS OF BURNING FOR SMALL DRY CELLS

Brand	Size of Cells—Inches					
	2¼x1¼	1 11/16x 11/16	2 1/16x¾	1 7/16x⅝	1 1/16x 1/16	1 7/16x 1/16
A	13.25	3.5	3.75	1.9	56 min.	70 min.
B	.....	3.6	4.2	1.7	.....	.....
C	10.5	2.	.....	.85	13 min.	.....
D	13.25	5.	4.2	2.0	63 min.	66 min.
E	13.75	4.1	.....	1.4	40 min.	.....
F	9.25	3.1	2.5	1.25	34 min.	45 min.
G	8.75	3.2	2.	1.1	.....	.....
H	13.25	4.3	4	1.9	40 min.	75 min.
I	9.00	.....	.....	1	.....	.....
J	.....	.....	.....	1.1	.....	.....

better indication than is the dropping in open-circuit voltage.

Dry cells vary in initial voltage far less than they do in other characteristics. The author pointed out that grades of materials supplied as well as the methods of manufacture influence the voltage to a small degree. Likewise the ability of a battery to "recuperate" can

TABLE III—DURABILITY OR SHELF WEAR FOR SMALL DRY CELLS
Expressed in Monthly Percentage Reduction in Flash

Brand	Size of Cells—Inches					
	2¼x1¼	1 11/16x 11/16	2 1/16x¾	1 7/16x⅝	1 1/16x⅝	1 7/16x 1/16
A	3.66	8.3	9.2	9.	12.	9.3
B	1.55	6.45	9.1	10.	.....	.....
C	1.87	3.83	.....	5.	25	.....
D	2.40	5.7	5.0	8.1	6.6	10.5
E	5.10	7.5	.....	9.6	14.	15.3
F	14.3	11.2	14.1	25.0	.....	14.0
G	10.8	12.	10.	22.0	25	.....
H	10	12.5	9.1	15.0	27	13.3
I	2.64	.....	.....	6.2	.....	.....
J	.....	.....	.....	.....	.....	.....

be given to a cell by certain variations in the methods of manufacture. Thus a coarser grade of manganese will show a higher recuperative ability than will a very finely powdered more active grade. In general, it may be considered that high recuperative ability is inconsistent with ability to deliver current constantly without serious dropping in voltage.

TABLE IV—PERFORMANCE THAT SHOULD BE EXPECTED FROM GOOD QUALITY OF DRY CELL

Cell Dimension	Capacity, Minutes	Per Cent Monthly Deterioration
2.25x1.25 in. (57.2x38.8 mm.)	960	Under 4
1.8125x0.9375 in. (46.1x23.8 mm.)	300	Under 6
2.125x0.75 in. (54x19.1 mm.)	250	Under 8
1.875x0.625 in. (47.7x15.9 mm.)	120	Under 10
1.5625x0.5625 in. (39.7x14.3 mm.)	65	Under 12
1.875x0.5625 in. (47.7x14.3 mm.)	70	Under 12

The data in Tables II and III give results of tests on different brands of dry cells purchased in the open market. The capacity tests show that the best cells have a capacity of about 100 per cent above the poorest, and from the durability tests the differences are much greater. The performance that should be expected of good quality dry cells is shown in Table IV.

Alternating-Current Service for an Office Building

Substation Arrangements, Power, Lighting and Heating Requirements and Provisions to Supply Water Automatically by an Air Lift from Artesian Well

BY CHARLES KLAPPER

THE fourteen-story building in St. Paul, Minn., which houses the offices of the Great Northern and the Northern Pacific Railways and the First National Bank of St. Paul, uses alternating current for all of its electrical requirements from the distribution system of the Consumers' Power Company. Electrical energy is supplied to this building at 2360 volts and steam for heating at 3 lb. pressure. Energy is purchased at the primary voltage, making it necessary for the owners to operate a substation. Space for this substation was provided in the sub-basement.

Two power lines lead into a fireproof transformer vault to a bus which divides into two sections, one for power and one for lighting, as seen in Fig. 2. This scheme was adopted because of considerations of continuity of service and maximum safety. If one of the three transformers is disabled, it is possible to disconnect this unit and operate the remaining two open delta. Also, if one

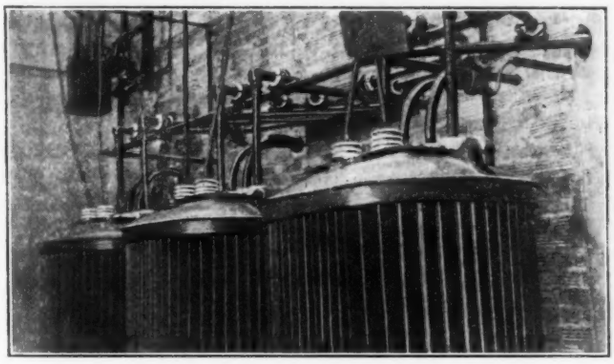


FIG. 1—THREE 150 KVA. POWER TRANSFORMERS FOR 230 VOLT THREE PHASE SERVICE

of the lighting transformers is disabled, the oil switch may be opened and the secondary buses bridged to those of another lighting transformer by a set of flexible leads kept in the vault. All secondaries are arranged for facilitating such connections, and solderless connectors are used on both sides of the transformer. For maximum safety, the neutrals of all lighting feeders and the transformer cases are grounded. Not to exceed 115 volts to ground exists on the lighting circuit. The power secondaries are also grounded at a neutral point.

Two other schemes of connections in the transformer room entailing much less expense were considered but rejected because either assurance of continuity of service or safety would be sacrificed. The first of these provided for a single bank of three transformers, delta connected on both sides, each of which would carry one-third of the power load plus the lighting load of one of the three tenants. The objections to this scheme were that the lighting feeders of only one tenant could have a grounded neutral since there would be 115 volts between the neutrals on the delta. Thus the neutrals of the other two tenants' feeders would have a potential of 115 volts above ground. Accidents, short-circuits and fires might result from this condition due to the fact that neutrals are invariably considered at ground potential. A further objection was that there is approximately 200 volts between line *A* (Fig. 4), and ground. Anyone coming in contact with line *A* on a lighting or plugging connection would therefore be subject to a 200-volt alternating-current shock.

The other scheme considered, but discarded, provided for a single bank of three transformers delta-connected on both sides, two of which would each carry one-third of the power load, while the third would carry the entire

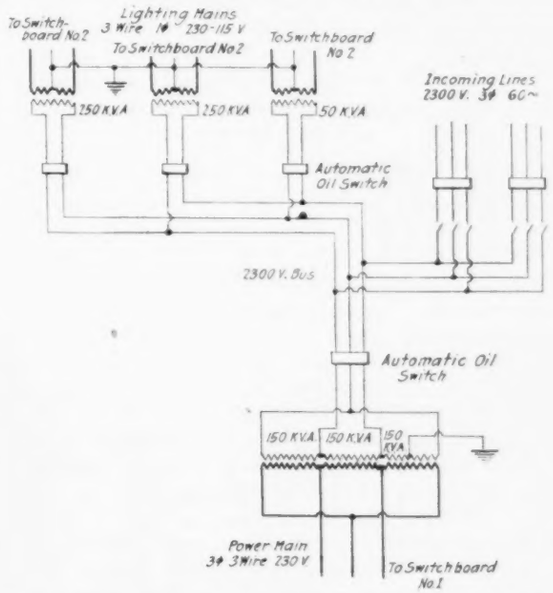


FIG. 2—ARRANGEMENT OF INCOMING LINES AND LIGHTING AND POWER CIRCUITS

lighting load plus one-third of the power load. The objection to this scheme was that if the transformer carrying the lighting load was out of commission, the lights of the entire building would be out, and there would be no reserve provision.

VARIETY OF POWER REQUIREMENTS

Owing to special requirements of different machines and to standard code rulings several varieties of power

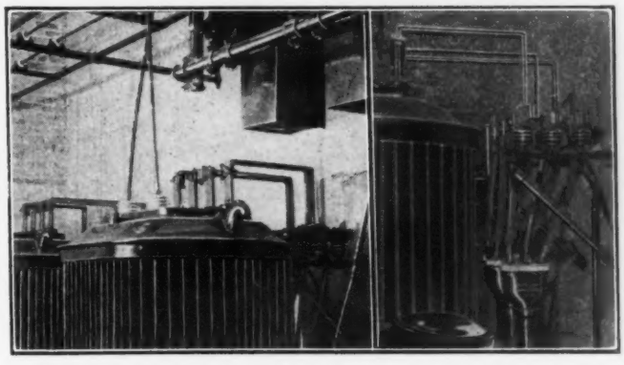


FIG. 3—LOW TENSION CONNECTIONS FOR 250 KVA. LIGHTING TRANSFORMER BANK

supply were required. The power load, a schedule of which follows, is composed almost entirely of three-phase induction motors. Single-phase power was required for the blueprint machines, since it was claimed by the manufacturers that uneven printing would re-

sult from a 6-arc machine operating on three different phases. For the operation and control of the automatic elevators, 220-volt direct current was requested by the manufacturers and 15-volt direct current was used for the push buttons, buzzers and watchman's time detectors because of a local ruling requiring 110-volt N. E. C. wiring for secondaries of bell-ringing transformers.

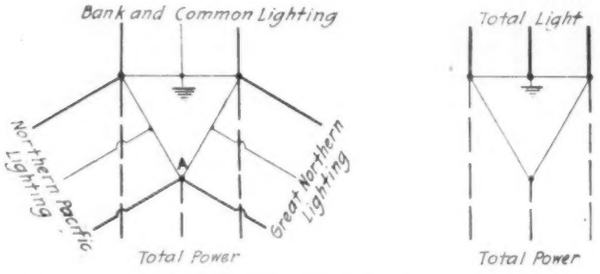


FIG. 4—TRANSFORMER CONNECTIONS FOR LIGHTING AND POWER SERVICE

This latter rule made the use of alternating current for the large amount of low-voltage wiring in the building impractical because of the prohibitive cost, and hence the reason for the 15-volt direct-current system.

Motor Installation

Wherever the starting load is light, as on d.c. generators, centrifugal pumps, and the rotary vacuum pumps, squirrel-cage motors were installed. Slip-ring motors were used for the variable speed fans, and the pumps starting under heavy load. The Underwriters' rules demand a slip-ring motor for the fire pump, and one was used for a large centrifugal elevator pump, as well.

Six running speeds for use during the different seasons are provided for the ventilating fans by manually operated controllers. The air washers, vacuum pumps and d.c. generators are controlled by manual compensators since they run continuously, and the fire pump is started by a standard Underwriters' manual controller. All other motors are operated by remote-control starters because of the intermittent service, and of these, all except the d.c. elevator motors operate automatically from pre-set pressures or water levels.

Automatic Water Supply for Building

Water is obtained for use throughout the building from an artesian well 400 ft. deep, by means of an air lift capable of delivering 750 gal. per minute. The lift discharges into an open steel surge tank in the sub-basement and from here the water is lifted by a 200 gal. per minute centrifugal pump to four steel tanks of 5000 gal. capacity each, located in a house on the roof. The water supply is maintained automatically by self-starters on the air compressor and house pumps actuated by float switches at the tanks. Possible shut-down is guarded against in case of failure of the well or lifting apparatus, by two city water supply lines piped to the surge tank, and by duplicate house pumps.

A triple-plunger deep well pump would have been more efficient in place of the equipment used, but it was necessary to obtain at least 750 gal. per minute for the fire pump, and the only way to obtain this without the use of excessively large equipment and a great amount of floor space was to utilize the air lift. The triple-plunger pump would also not provide any protection against failure of the house tank supply due to a shut-down of the pump.

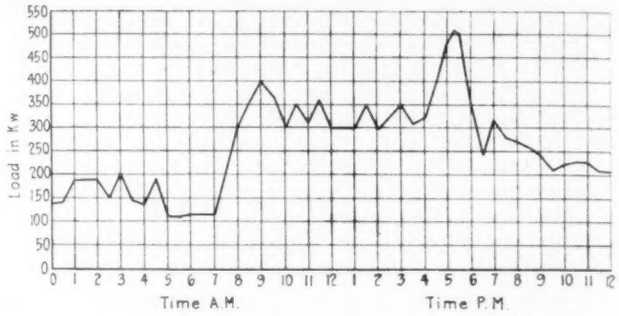
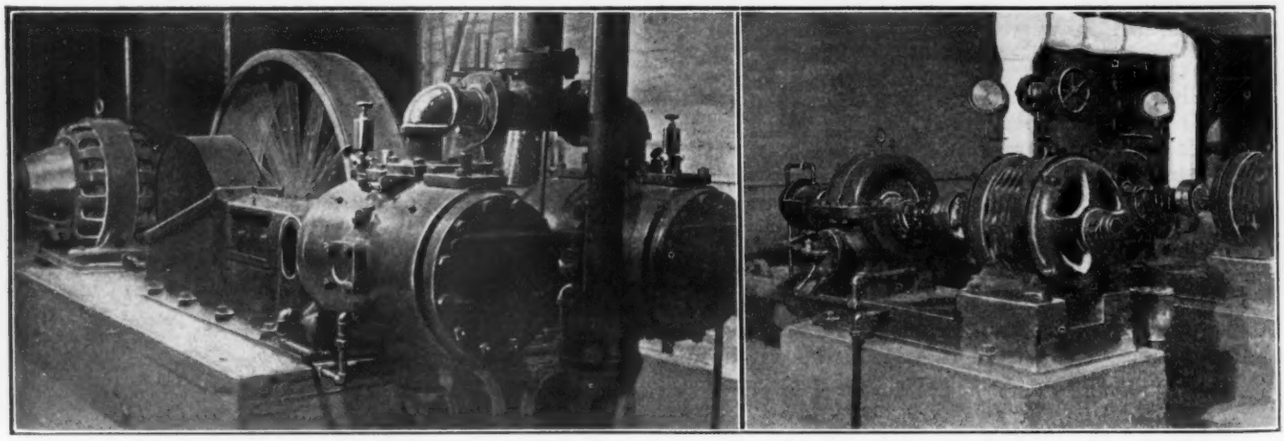


FIG. 7—TYPICAL LOAD CURVE FOR A ST. PAUL OFFICE BUILDING

A test of the water supply equipment made recently showed an expenditure of 2.2 kw.-hr. per 1000 gal. of water delivered to the house tank. The water in the well averaged about 15 ft. below the surface of the floor when the pumps were in operation, and the air lift discharge is 11 ft. above the floor. The house pump head is 210 ft., thus making a total head of 236 ft.

The building is equipped with nineteen elevators, sixteen of which are hydraulic of the direct-acting plunger type comprising twelve high-speed passenger elevators, only eight of which are used at present, two combination freight and passenger elevators, and two sidewalk lifts. They are served from two sets of tanks in which the pressure is maintained automatically between 200 lb. maximum and 165 lb. minimum by four motor-driven pumps started at different tank pressures by contact pressure gages, drum controllers and Mason regulators. Two of these units are driven by 75-hp. slip-ring motors connected by short belts to 500-gal. per minute triplex pumps. These units operate intermittently and are sufficient at present for the load except during the rush periods when a third unit is occasionally operated.



FIGS. 5 AND 6—DUPLEX AIR COMPRESSOR DRIVEN BY 40 HP. MOTOR AND TWO HOUSE PUMPS EACH DRIVEN BY A 30 HP. MOTOR WITH SELF STARTERS

TABLE I—SERVICE SUPPLIED BY ALTERNATING CURRENT, THREE-PHASE, 220-VOLT MOTORS

Service	Number of Motors	Apparatus Operated	Motor Rating in Horsepower	Total Motor Horsepower
Heating and ventilating system	2	Air washers*	3	6
	1	Air washer*	7½	7½
	1	Air compressor*	3	3
	2	Plenum fans	5	10
	1	Plenum fan	7½	7½
	1	Plenum fan	25	25
	4	Exhaust fans	3	12
	1	Exhaust fan	7½	7½
	1	Exhaust fan	10	10
	2	Vacuum pumps*	15	30
Hydraulic elevators	1	Air compressor	15	15
	2	Triplex pumps	75	150
	1	Triplex pump	200	200
	1	Centrifugal pump	250	250
Water supply	2	Centrifugal pumps*	30	60
	1	Air compressor	40	40
	1	Fire pump (centrifugal)	125	125
Basement sewage ejector	2	Centrifugal pumps*	5	10
Telephone company storage battery	1	Motor generator, 110 volts, direct current*	7½	7½
Buzzer service	2	Motor generators, 15 volts, direct current*	1	2
Electric elevators and pneumatic tubes	1	Motor generator, 230 volts, direct-current*	75	75
		Total alternating current, three-phase horsepower	..	1,053

*Squirrel cage motors. Remainder are slip-ring designs.

TABLE II—SERVICE SUPPLIED FROM 220-VOLT SINGLE-PHASE AND 230-VOLT, TWO-WIRE DIRECT-CURRENT CIRCUITS

Service	Apparatus Operated	Motor Rating	Total Motor Horsepower
Blueprint machines	From single-phase circuits: 17-arc lamps and 5-hp. in motors	..	5
Elevators	From direct current circuits:		
	2 private automatic	11	22
	1 public	25	25
	1 mail	5	5
Pneumatic tubes	1 exhauster	20	20
	Total direct-current motor load	..	72
	Total connected motor load	..	1,130

This unit is composed of a 200-hp. motor connected by a short belt to a 1700-gal. per minute triplex pump. The fourth unit is a centrifugal pump of 1700 gal. per minute capacity direct connected to a 250-hp. motor running at 1760 r.p.m. and serving as a relay. The controlling devices of the several units are set to cut in at different pressures so that the first unit will operate practically continuously during the day. The second unit starts up intermittently after the pressure is reduced faster than the first unit can maintain it, down to a certain lower pressure, when the third unit cuts in as the pressure is still further reduced. The two 75-hp. units are frequently reversed in their order of cutting in by changing the controlling mechanism so that one unit will not be required to do the heavy work continuously.

On account of the very large floor area of the building the lighting risers are carried up at four different points, each riser feeding four cabinets and each cabinet feeding one-fourth of a floor. Telephone and buzzer wires are carried in conduit from a steel cabinet on each floor to the walls and interior columns, where they are extended in a special wire carrying baseboard. A window is built into the riser shaft on each floor to provide plenty of daylight by which to work on the wiring system. The telephone and telegraph cable risers are lead covered and the light and power risers are rubber-covered.

OPERATING DATA

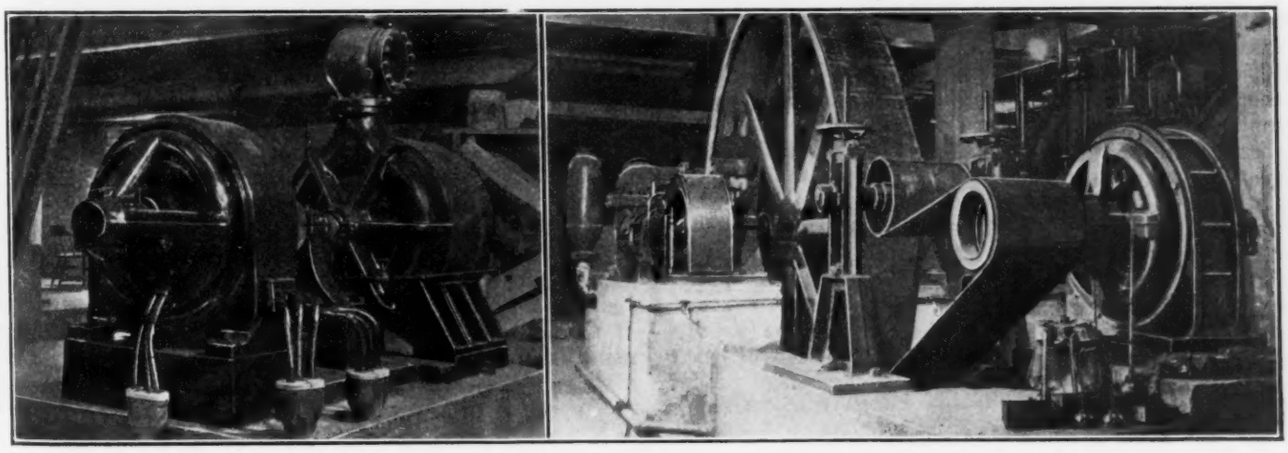
Since Feb. 1, 1916, at which time the tenants moved all their offices into the building, tests were made to determine some of the characteristics of the installation. The building is fourteen stores in height and, with two basements, has an available floor area of more than 700,000 sq. ft.

Number of occupants in building	3,000
Connected power load in horsepower	1,088
Average power demand (day), horsepower	300
Connected lighting load, kilowatts	500
Peak lighting load, kilowatts	350

For twenty-six days, including three Sundays and four Saturdays, the light consumption was 58,000 kw.-hr. and the power consumption was 52,000 kw.-hr. The average power factor on the entire load was 83 per cent with but slight variation.

The steam which is used for direct and indirect radiation and for the hot water supply system is supplied through a 14-in. insulated main at about 3 lb. pressure and reduced at the main header to atmospheric pressure for operation by thermostatic control. The heat supply must be sufficient for a total direct radiation of 70,000 sq. ft. and a total vento radiation of 6000 sq. ft. From Feb. 1 to Feb. 3, inclusive, with a mean daily temperature of —8 deg. Fahr., the steam consumption for heating the building averaged 460,000 lb. daily, and for heating water, 7500 lb. The maximum temperature during this period was +3 deg. and the minimum —20 deg.

The Toltz Engineering Company of St. Paul had charge of the engineering work for the building, and the Electrical Construction Company of St. Paul, was the electrical contractor.



FIGS. 8 AND 9—HYDRAULIC ELEVATOR UNIT NO. 4 DIRECTLY DRIVEN BY 250-HP. MOTOR AND TRIPLE-PUMP UNIT NO. 1 WHICH IS BELT CONNECTED WITH A 75-HP. MOTOR

Motor Drive for Operating Steel Rolling Mill

Analysis of Requirements of Steel Rolling Mill Electric Drives and a Graphical Solution of the Load Imposed on a Motor

BY WILLIAM KNIGHT
Member Engineering Staff Crocker-Wheeler Company

IN what follows here a rapid survey will be made of the main points to be considered in designing an electric drive for a rolling mill with an explanation of a graphical solution of a simple formula which, it is hoped, will simplify the necessary calculations for determining the load imposed on the motor at any instant during the process of rolling. In order to combine efficiency and economy in rolling mill drives the demand for power on the generating station must be as steady as possible. This is usually obtained by using a flywheel in conjunction with the motor and a speed-controlling device which reduces the speed of the motor and flywheel, enabling this to give up some of its stored energy during the period of retardation. The stored energy of the flywheel varies as the square of the speed at which it is running. If no speed controlling device is used, the flywheel alone in most cases cannot take care of the peak loads on the mills because the reduction in speed is not large enough to enable the flywheel to supply the necessary energy. An ordinary three-phase induction motor will fall in speed about 2 per cent from no load to full load. The energy given up by the flywheel for a 2 per cent reduction in speed will be only 4 per cent of its stored energy. Suppose that during a few seconds, when the ingot is between the rolls, the demand power on the motor is equivalent to four times the normal load of the motor, the flywheel will have to supply the balance of energy required. Commercial motors can stand a momentary overload of only 100 per cent for a few seconds without being injured. If we assume that the motor would fall in speed about 6 per cent from no load to 100 per cent overload, the flywheel would give up only about 11 per cent of its stored energy, and in order to supply the balance of energy equivalent to four times the normal load of the motor, which is required for a few seconds when the ingot is between the rolls, the inertia of the flywheel and motor would be such that a flywheel abnormally heavy should be used which would not be a commercial proposition. If, instead, we artificially increase the slip of the motor as the demand of power increases (say, for instance, a 20 per cent slip is provided from no load to 100 per cent overload), the percentage of energy given up by the flywheel will be 36 per cent instead of 11 per cent, and the needed flywheel effect will be 3.3 times smaller than it would have been if no speed controlling device had been used. In this case a flywheel of moderate weight and size could be successfully used to take care of heavy demands of power for a short time only.

Two devices are generally used for controlling the fall in speed of the motor, the continuous slip regulator and the intermittent slip regulator. The continuous slip regulator consists of a resistance permanently inserted into the rotor circuit of the motor, which produces a steadily increasing fall in speed as the power increases. The intermittent slip regulator consists of a resistance which is inserted into the rotor circuit of the motor when the power demand reaches a definite value. This latter type of slip regulator (which at first sight might appear as being the ideal mechanism required) has the objectionable feature of taking from one to two seconds to come into operation and, as the demand for power on the motor is instantaneous when the billet enters the rolls and the peak load has sometimes the duration of one second only, the full demand of power will be thrown on the motor before the intermittent slip regulator can operate, causing the circuit breaker to open. Careful tests have also shown that the waste of power produced by the operation of either form of slip regulators is practically the same.

The choice of the proper motor and flywheel to operate one or more rolling mills is subject to several considerations. One of the most important considerations is whether the power is generated within the works, or whether it is supplied from an outside source. If several rolling mills, all doing similar work, are in operation all at the same time, an automatic balance of the demand of power can be obtained and flywheels of small sizes can be successfully used with the mill motors. In this case the demand will remain fairly constant and an economic electric drive will be secured, whether the power is generated within the works or purchased.

If the power is generated within the works, it is essential that the demand on the power station be kept as uniform as possible, and this is obtained by using heavy flywheels and a proper regulation of slip. It must be borne in mind, however, that the increase in size of the flywheels means an increase of capital charges and an increase of running cost due to the friction in bearings and windage, and that the slip of the motors cannot exceed a given amount without reducing the output of the mill. Evidently, there is a point when the increase of capital charges and running cost will balance the saving effected by running the generating station at a constant load.

The speed of a rolling mill is generally limited by the first passes in the roughing rolls. When the billet is very short, and is thrown out at a high velocity it will be very difficult for the men to catch it. In the latter passes, instead, the bar will be considerably elongated and a very long time will be required in the last passes, where, instead, a high speed is most desirable from a manufacturing standpoint, while a considerable fall in speed is necessary in order to utilize the stored energy of the flywheel. This inconvenience is overcome by using a separate motor generator set and flywheel running at a comparatively high speed, supplying current to the mill motors which may be run at a constant speed or (if the Ilgner system is used) at a variable speed, which may be obtained by varying the voltage of the generator of the motor generator set. In this way a very rapid increase or decrease in speed of the mill motors may be obtained and the tonnage that the mill can roll is greatly increased and a reduction in cost of production will result in spite of the increased capital cost of the electrical plant.

When the power is obtained from an outside source the charges are generally made either on the maximum demand system, in which case payments are made by reckoning on the maximum demand for a fixed number of hours per month at a certain rate, and on the rest of the power at a much smaller rate per unit. In this case large flywheels are needed in order to reduce the fluctuation of power. Again the power may be purchased at a flat rate for the number of units consumed, and in this case it is essential to reduce the friction losses by

using small flywheels and large motors. In the latter case, the friction losses may be reduced to a minimum by doing away with the flywheels entirely and using motors large enough to take care of the peak loads on the mill at a speed practically steady. In this way a cheap price for the power and the maximum output is obtained, but the capital charges are increased due to the increased cost of the motors.

Particular attention should be paid to the friction losses and, in general, to all those losses which are more or less steady, independent of the output of the mill. In many mills the friction of the mill itself is about 20 per cent of the normal rated output of the motor, and the total friction losses are about 50 per cent of the power used per ton rolled.

The size of a motor for a given service may be determined by the mean effective current of the duty cycle.

$$I_e = \sqrt{\frac{\Sigma I^2 t}{\Sigma t}}$$

or:

$$\text{Horsepower rating} = \sqrt{\frac{\Sigma HP^2 t}{\Sigma t}}$$

This is the mean rating that will give the same heating effect as the given loads I (or hp.) acting successively for periods of time t. After the minimum size of motor that can be used for a given duty cycle of a rolling mill

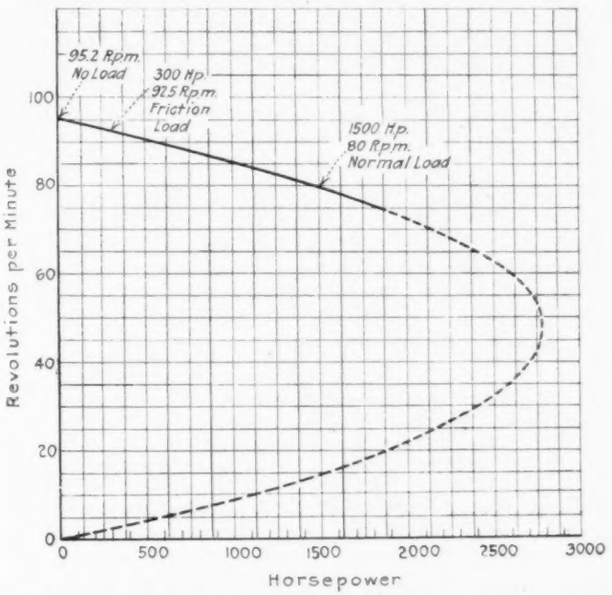


FIG. 1—LOAD CARRIED BY 1500-HP. 80-R.P.M. MOTOR AT DIFFERENT SPEEDS WHEN TORQUE AT ANY SPEED VARIES AS THE SLIP

has been found, the proper size of flywheel to use in connection with the motor must be found in a tentative way when the allowable slip and the overload capacity of the motor are specified.

For instance, let us assume a 1500-hp. induction motor to run at about 80 r.p.m. with a slip of 20 per cent from no load to the maximum of 1875 hp. coupled to a blooming mill, and let us find the proper size of flywheel to use.

With a 1500-hp., 80-r.p.m. motor, normal load torque $= 5252 \times 1500 : 80 = 98{,}500$ ft.-lb. Torque at 25 per cent overload = 123,000 ft.-lb.; speed drop from no load = 20 per cent (slip).

We will assume that the torque is proportional to the slip, then the slip at normal load will be: $(98{,}500 \div 123{,}000) \times 0.2 = 16$ per cent (slip from no-load speed). If we call y the no-load speed, we will have $(y - 0.16y) = 80$ r.p.m. from which $y = 95.2$ r.p.m. This is the speed of the motor at no-load and zero slip.

By laying out the per cent of normal load torque against the per cent of no-load speed for two points, zero load against zero slip and 125 per cent full load against 80 per cent of no-load speed (giving the required 20 per cent slip) and connecting these two points with a straight line, the speed at any other torque and vice versa can be shown as in Fig. 2.

The torque and the speed corresponding to any other

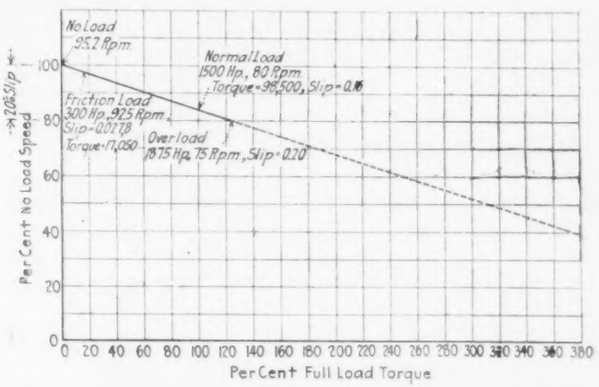


FIG. 2—VARIATION OF TORQUE WITH SLIP FOR 1500-HP. 80-R.P.M. MOTOR DRIVING BLOOMING MILL

given horsepower may be found in the following way:

By keeping in mind that the torque at any speed is assumed to be proportional to the corresponding slip s expressed in percentage of the no-load speed, the torque and the speed corresponding to any horsepower may be found as follows, remembering that the r.p.m. is equal to $95.2(1 - s)$:

$$(5252 \times 1500 \div 80) \div [5252 \times \text{hp.} \div 95.2(1 - s)] = (0.16 \times 95.2) \div (s \times 95.2)$$

From this:

$$\frac{1500}{80} \div \frac{\text{hp.}}{95.2(1 - s)} = \frac{0.16}{s}$$

$$\frac{1785(1 - s)}{\text{hp.}} = \frac{0.16}{s} \quad \text{and hp.} = 11{,}156(s - s^2)$$

= horsepower corresponding to a given slip (1)

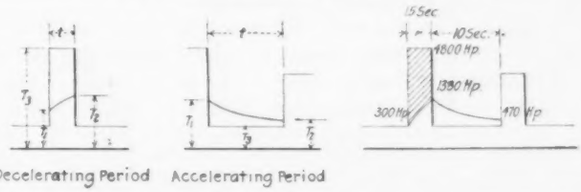
$$s = 0.5 - \sqrt{0.25 - \frac{\text{hp.}}{11{,}156}}$$

= slip corresponding to a given hp. (2)

$$\text{R.p.m.} = 95.2(1 - s) = 47.6 + \sqrt{2260 - 0.81\ \text{hp.}}$$

= speed corresponding to a given hp. (3)

By inspecting formula (2) it is observed that real values are obtained for s up to the limit when (hp. ÷ 11,156) is less than 0.25. Beyond this limit we obtain imaginary quantities for s. This means that under these conditions the point at which hp. = 2789 is the point at which the motor will break down, and for any increase in slip we will find a drop in horsepower.



FIGS. 3 AND 4—TORQUES OF FORMULA 5 DURING DECELERATING AND ACCELERATING PERIODS

The curved line in Fig. 1 shows horsepower plotted against speed. At any point of this curve the speed is $= 95.2(1 - s)$, corresponding to the straight line relation of torque against slip shown in Fig. 2. It will be noticed that between the limits the motor will be operated (from 300 hp. friction load to about 1875 hp. corresponding to 25 per cent overload), the curve is nearly a

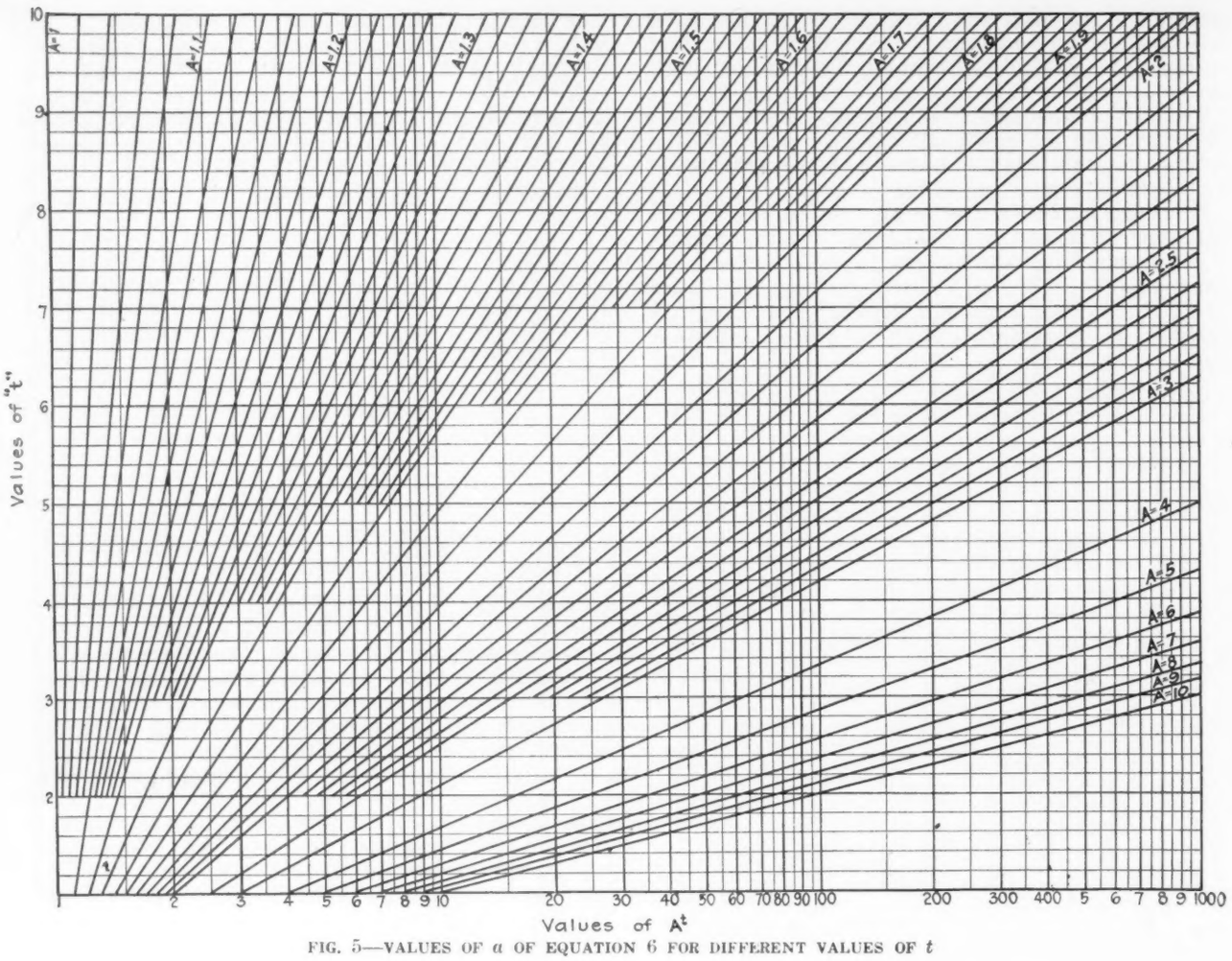


FIG. 5—VALUES OF a OF EQUATION 6 FOR DIFFERENT VALUES OF t

straight line, or, in other words, the horsepower is nearly proportional to the slip. Figs. 1 and 2 are by no means correct representations of motor performance at any overload. They simply represent the relation that would exist if the assumption that the torque is proportional to the slip was true for any overload.

If we compare the (hp. $\times$ seconds) needed on the rolls for every peak, the approximate point where the maximum demand on the motor is liable to occur will be found. Assume, for instance, a certain peak load of 2820 hp. for 3.73 seconds. The corresponding hp. $\times$ seconds = 10,500. That supplied by the motor is 1500 $\times$ 3.73 = 5600. The difference of 4900 hp. $\times$ seconds will have to be supplied by a flywheel. If it is known that after taking up any peak the motor had time enough to reach the speed corresponding to friction load (92.5 r.p.m., see Fig. 2), all that would be required would be to supply a flywheel capable of giving up 4900 hp. $\times$ seconds of its stored energy in slowing down from 92.5 r.p.m. to 76.16 r.p.m., the speed corresponding to the maximum 20 per cent slip that can be allowed. If WK^2 is the lb.-ft.^{2} flywheel effect of the flywheel and rotor, we have:

$$WK^2 = \frac{\text{hp.} \times \text{seconds}}{0.000{,}000{,}31(N_1^2 - N_2^2)}$$

$$= \frac{4900}{0.000{,}000{,}31\,(92.5^2 - 76.16^2)} = 5{,}800{,}000 \text{ lb.-ft.}^2 \quad (4)$$

Due to the fact the speed of the motor is not known just before taking up the peak in consideration, in order to make allowance for this unknown we increase by 50 per cent the above flywheel effect and figure on using a flywheel having a flywheel effect of 8,950,000 lb.-ft.^{2} Having found the flywheel effect WK^2, the mass moment of inertia of our flywheel and rotor will be:

$$MK^2 = \frac{WK^2}{g} = \frac{8{,}950{,}000}{32.16} = 278{,}000$$

If p is considered the constant ratio of torque to slip of the motor, we will have:

$$p = \frac{\text{any torque}}{\text{corresponding slip}} = \frac{98{,}500}{0.16} = 615{,}000$$

Calling v_s the no-load speed at 1 ft. radius, we have:

$$v_s = \frac{2\pi \times 95.2}{60} = 10 \text{ ft. per second.}$$

Several formulas have been derived for obtaining T_2 (see Fig. 3), all expressed in a more or less complicated form. They may be expressed much simpler as follows:

$$T_2 = \frac{T_1 - T_3}{e^{\frac{pt}{MK^2 v_s}}} + T_3 \quad (5)$$

Where e is the base of the Naperian logarithm = 2.718, T_1, T_2, T_3 are the torques corresponding to Fig. 3, and t is the time in seconds at the end of which T_2 is calculated.

For a given combination of flywheel and motor $e^{\frac{pt}{MK^2 v_s}}$ is a constant and the above formula may be expressed in the simple form

$$T_2 = \frac{T_1 - T_3}{A^t} + T_3 \quad (6)$$

In the case under discussion $A = 1.25$.

Considering that during the decelerating period the minimum value that T_2 may reach is $T_2 = T_3$, and during the accelerating period the maximum value that T_2 may reach is $T_2 = T_1$, it is observed that this condition is reached when in the above formula $A^t = 1$. If the values of A^t are plotted for a given range of values of

A and t we will have to set as a minimum value $A^t = 1$. The maximum value that T_2 may reach during the decelerating period is $T_2 = T_3$ approximately, and the minimum value that T_2 may reach during the accelerating period is also $T_2 = T_3$. This condition is reached when $\frac{T_1 - T_3}{A^t}$ is very small as compared to T_3, say, for instance, $\frac{T_1 - T_3}{A^t} = \frac{T_3}{100}$, and considering that in practice T_1 is about 20 per cent of T_3 during the decelerating period, and about $5T_3$ during the accelerating period. Substituting and solving for A^t we find that the maximum value that A^t may reach is about eighty during the decelerating period and 400 during the accelerating period.

If we set as a limit of maximum value that A^t may reach, $A^t = 1000$, and plot the values of A^t between the limits of $A^t = 1$ and $A^t = 1000$, we will have covered about every case of electric drive of rolling mills. (See Fig. 5.)

Due to the fact that p, MK^2 and V_s are connected one to the other in such a way as to give a rather limited range of values of $\frac{p}{MK^2V_s}$ it will be found that the values of A given in the diagram will be sufficient for taking care of every case. The values of t given vary between $t =$ one second to $t =$ ten seconds. If it is desired to have values of A^t for corresponding values of t larger than ten seconds, find the point corresponding to A^{10}. Trace vertically downward from this point as many seconds back of the line corresponding to ten seconds for as many seconds more than ten as it is desired to find A^t, and from this point trace a parallel to the line corresponding to the given value of A until it strikes the line of $t = 10$. The point on that line will be the value desired. For instance, if it is desired to find 1.12^{12} proceed as follows: Find $1.12^{10} = 3.1$, trace vertically two seconds back of 10 (stop on the line $t = 8$), and from that point trace a parallel to $A = 1.12$, which will strike the line $t = 10$ at the point 3.9. This point will represent the value desired of 1.12^{12}.

Applying the above formula to the numerical example under consideration, and starting at the beginning of the duty cycle of the motor, we have at starting (see Fig. 4):

$$T_1 = \text{friction torque} = \frac{5252 \times 300}{92.5} = 17{,}050$$

$$T_3 = \frac{5252 \times 4800}{92.5} = 272{,}000$$

$$A = 1.25 = \text{constant}$$

$t = 1.5$ second; $A^t = 1.4$ (from Fig. 5)

$$T_2 = \frac{T_1 - T_3}{A^t} + T_3 = -\frac{254{,}950}{1.4} + 272{,}000 = 90{,}000$$

The above value of T_2 is 91.5 per cent of the normal torque (normal torque = 98,500). From Fig. 2 we find that the corresponding speed is 85.3 per cent of the no-load speed, or 81 r.p.m., and from Fig. 1 we find that the corresponding horsepower load on the motor after taking up the first peak is 1380 hp.

During the accelerating period we have:

$$T_1 = 90{,}000$$

$$T_3 = \frac{5252 \times 300}{81} = 19{,}400$$

$$A^t = 1.25^{10} = 9.1 \text{ (from Fig. 5)}$$

$$T_2 = \frac{T_1 - T_3}{A^t} + T_3 = \frac{70{,}600}{9.1} + 19{,}400 = 27{,}150 = 27.6$$

per cent of normal load torque, which corresponds to 470 hp. at 91 r.p.m. (See Figs. 1 and 2.)

As a means of checking the formula proceed as follows: Find the load on the motor during the accelerating period for a number of values of t between $t = 0$ and $t = 1.5$ and plot these loads. A logarithmic curve will be obtained. Measuring with a planimeter the shaded area on Fig. 4, that area will represent the energy in horsepower-seconds given up by the flywheel in slowing down from 92.5 r.p.m. to 81 r.p.m., and must be equal to the calculated energy given up by the flywheel during the retardation period:

$$\begin{aligned}\text{Hp.-seconds} &= 0.000{,}000{,}31 \times WK^2(N_1^2 - N_2^2) \qquad (7)\\ &= 0.000{,}000{,}31 \times 8{,}950{,}000\ (92.5^2 - 81^2)\\ &= 5600\end{aligned}$$

In the same way the area comprised between the motor-load curve and the friction load during the accelerating period must be equal to the energy necessary to accelerate the flywheel from a speed of 81 r.p.m. to 91 r.p.m.

The load on the motor at any instant during the duty cycle may be found in the same way. If we find that either the slip or the overload exceeds the limits set (20 per cent slip and 25 per cent overload), it will be necessary to assume a different value of WK^2, and try again until a value of WK^2 is found that will satisfy the conditions.

When the proper value of WK^2 has been found the dimensions of the flywheel may be calculated, keeping in mind that if a cast-iron flywheel is used the peripheral speed must not exceed 6000 ft. per minute, and if cast steel is used 12,000 ft. per minute is the maximum allowable speed. It is also well to bear in mind that the windage losses vary as the fifth power of the diameter and the cube of the speed.

If the flywheel is mounted on a separate shaft running at N' revolutions per minute (speed of motor = N r.p.m.), the flywheel effect of the flywheel varies directly as $\left(\frac{N'}{N}\right)^2$, so that if the flywheel on a separate shaft is running twice as fast as the motor, the flywheel effect needed of the flywheel will be only one-fourth of what we would have needed if the flywheel had been mounted directly on the motor shaft. In the previous calculations, however, it is simpler to always use a value of WK^2 corresponding to the case of a flywheel mounted on the motor shaft.

Interrupter for Limiting Peak Load Enjoined

The Niagara & Erie Power Company, Buffalo, N. Y., has obtained an injunction restraining the Seneca Iron & Steel Company of Buffalo from employing a contrivance which is alleged to interrupt the electric circuit, and through the use of which the Seneca company obtained a maximum of power at a minimum rate. At a hearing in Supreme Court of Erie County it developed that the power company was under agreement to furnish energy to the defendant and that the latter was to pay for the average of the highest daily one-minute peaks occurring during the month for which charge was made.

Demands greater than these peaks but lasting for less than one minute, were not to be considered. It is charged that a contrivance was obtained by the defendant which interrupted the circuit every fifty seconds so that at no time during the operation of the defendant's mills were the peak loads sustained for one minute. The court held the defendant had no right to defeat the contract by such a device.

Motor Trucks Equipped for Construction Service

How Various Electric Service Companies Have Provided Trucks with Both Electrical and Mechanical Equipment for Use in the Operating, Construction and Maintenance Departments

MANY electric service companies using motor trucks in connection with the operation and maintenance of their systems have provided them with special apparatus or equipments to expedite work or permit handling it in a more efficient or economical manner. In some cases the special equipment forms a permanent part of the vehicle, while in other instances the apparatus is arranged so that it can be attached to or removed from the truck without delay. Usually the bulkiness of the apparatus determines whether it is permanently or temporarily attached. Among the purposes for which the especially equipped trucks are used are setting and pulling poles, pulling cables, hoisting transformers to pole tops and lowering them into manholes, loading and unloading cable reels and other heavy materials or apparatus, maintaining street lamps, transporting fuel and ashes, pumping and ventilating manholes, carrying portable substation equipment, transporting tools, supplies and the like. Numerous examples of trucks equipped for these purposes are illustrated and described in what follows.

POLE-ERECTING DEVICES FOR TRUCKS

A specially equipped truck which is used by the Union Railway Company, New York City, in railway service, and is equally adaptable to central station use, consists of a gasoline-electric vehicle which combines a Couple-Gear drive with a gasoline-electric source of power. A gasoline engine direct connected to a generator provides the power which is conveyed directly to the motors in the wheels without any intervening resistors, transmission gears, clutches, or complicated starting switches. The motor speed is controlled by the gasoline-engine throttle and the tractive effort applied directly at the rims of the driving wheels.

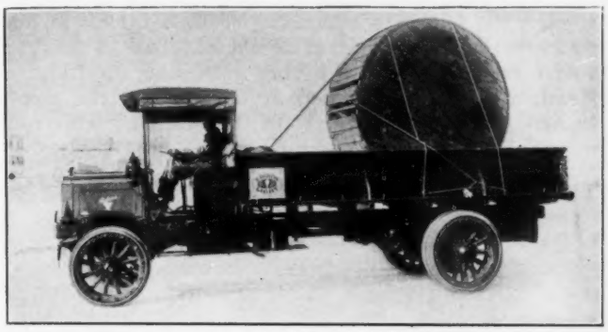
This truck has been equipped with a General Vehicle Sprague Type E-16 electric winch with the nigger-head projecting over the left running board. The winch has a pulling capacity of 3000 lb. at 50 ft. per minute, which has proved to be ample for severe service. In addition a 16-ft. 8-in. by 8-in. yellow-pine boom tapered to 5 in. by 5 in. has been supported on the rear end of the truck by an 8-in. channel iron brace with ratchet hoisting and lowering device similar to tower operating apparatus. The foot of the boom is supported on a roller made of an old pinion on which has been shrunk a steel band, so that the entire weight of the boom and its load may be supported on the ground directly rather than on the truck. A small screw jack permits adjusting the height of the boom.

With this truck thirty-nine poles were removed in six hours. In the same time this truck enabled setting twelve 900-lb. iron poles, including loading them onto a rear trailer, hauling them four blocks, unloading them on a bridge (where, with one roadway torn up, 150 vehicles were passing per hour), and placing each pole posed for bolting up. One pole was set in place of the stone abutment of the bridge alongside the bridge-tender's house, outside the railing, in less than forty-five minutes. This period included the time for building the runway to get the car on the sidewalk, and maneuvering the truck in a space less than 2 ft. wider and 10 ft. longer than the truck without damage to the bridge gates or the truck.

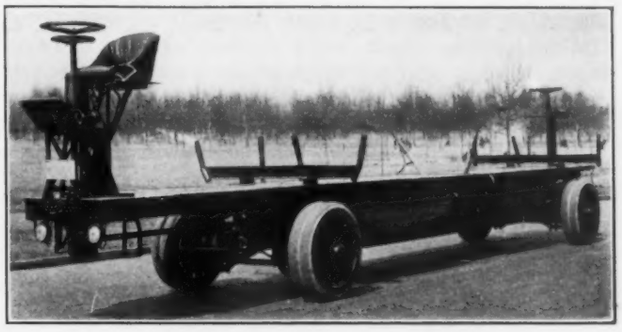
TRUCK WITH OFFSET CABLE-PULLING HEAD

In another case the gasoline-electric truck was used to remove some 600-ft. submarine cables from the Harlem River. This was done before the winch was installed, so another truck of similar design was hitched in tandem with the railway truck and the cables, which were buried in mud, removed by direct pull. The cables were thus withdrawn in a fraction of the time possible by any other method. For pulling purposes, the Couple-

BOSTON EDISON PORTABLE SUBSTATION FOR CABLE TESTING

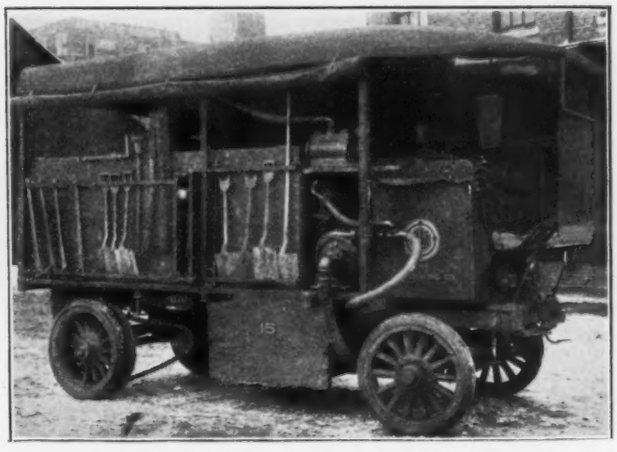


BOSTON TRUCK THAT LOADS CABLE REELS



PHILADELPHIA POLE-LOADING TRUCK

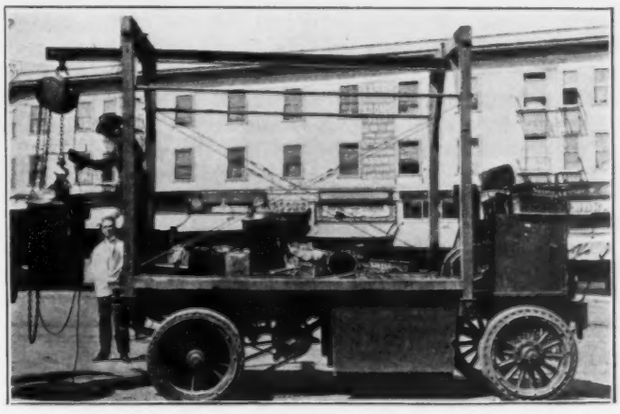
NEW YORK EDISON TRUCK ARRANGED FOR VERTICAL CABLE PULL



CLEVELAND TRUCK WITH TWO PUMPS AND A WINCH

ONE OF CLEVELAND'S TOOL-COMPARTMENT TRUCKS WITH RACKS FOR BULKY MATERIAL

BOSTON EDISON TRUCK PUMPING OUT MANHOLE



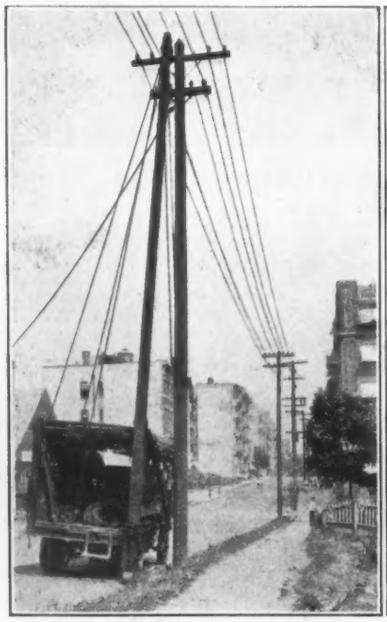
PACIFIC GAS & ELECTRIC TRUCK LOWERING TRANSFORMER

Gear cannot be excelled by a straight gasoline vehicle, according to James D. Kent, electrical engineer of the Union Railway.

Other companies using gasoline vehicles in construction work have had them equipped with winches, operated from the transmission of the motor truck by sprocket and chain. For this equipment one lever in addition to the regular number is necessary in order to throw in and out the gears which engage with the transmission. Trucks equipped in this manner can be used in pulling aerial or underground cable, hauling and setting poles, hoisting transformers, pumping out manholes, righting derailed cars and clearing tracks of obstructions. When double-drum winches are used it is possible to pull two sections of cable with one set up. The driver can operate the winch for pulling, loading and unloading cable without leaving his seat. With a four-speed transmission, cable can be pulled at a speed of 50 ft. per minute, or light pulls can be made at from 50 to 150 ft. per minute with as great a degree of safety as by hand.

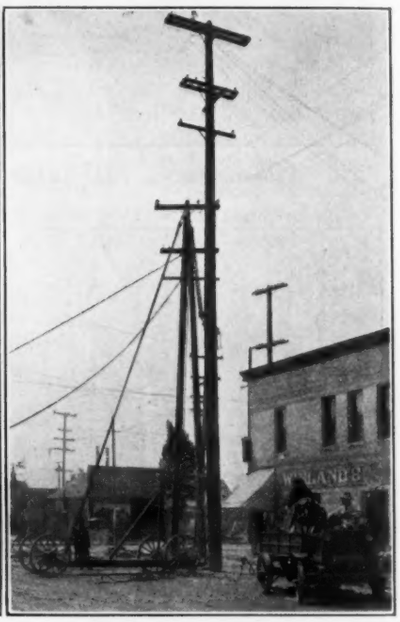
A pole-setting derrick has been developed by A. S. Blanchard, team foreman of the maintenance department of the Boston company for use on the rear end of the 2-ton electric trucks employed in line work. The derrick can also be used in handling heavy cement bases used with lamp poles, and also for installing transformers to manholes in some cases. The derrick consists of a spruce upright 17 ft. long by 6 in., notched to fit between the tailboard and the end of the vehicle. Bolted across the rear upright is a 4-in. by 6-in. crossarm used to steady the derrick. The latter is also guyed to the front uprights of the truck. The line used in hoisting is hauled in by a motor-driven hoist. During a recent job four 40-ft. chestnut poles were picked up, carried 200 ft. and set in holes within twenty-five minutes with a gang of only three men. No manual work except steadying and placing the poles in position was required, as the truck winch was used for the actual lifting.

In the overhead district of New York City, the New York Edison Company is using a special pole-erecting boom attached to a truck. As shown in an accompanying illustration, the boom is hinged about 8 ft. from its lower end, so it can be swung into a horizontal position and rest on the truck roof when not in use. Although the frame to which the boom is hinged is made of heavy steel channels, it is not required to carry the entire stress caused by lifting poles and the like. Instead, a roller is provided at the foot of the pole to transmit the stress directly to the ground. This roller may be adjusted in height by means of a screw.



NEW YORK EDISON TRUCK WITH POLE-SETTING BOOM

SOUTHERN CALIFORNIA EDISON TRUCK HOISTING TRANSFORMER



SOUTHERN CALIFORNIA EDISON POLE-SETTING EQUIPMENT

An electric truck completely equipped with all tools and mechanisms needed in the process of pulling in underground cable, and having a body which provides a compact place for everything, has been designed by men in the underground cable department of the Commonwealth Edison Company, Chicago.

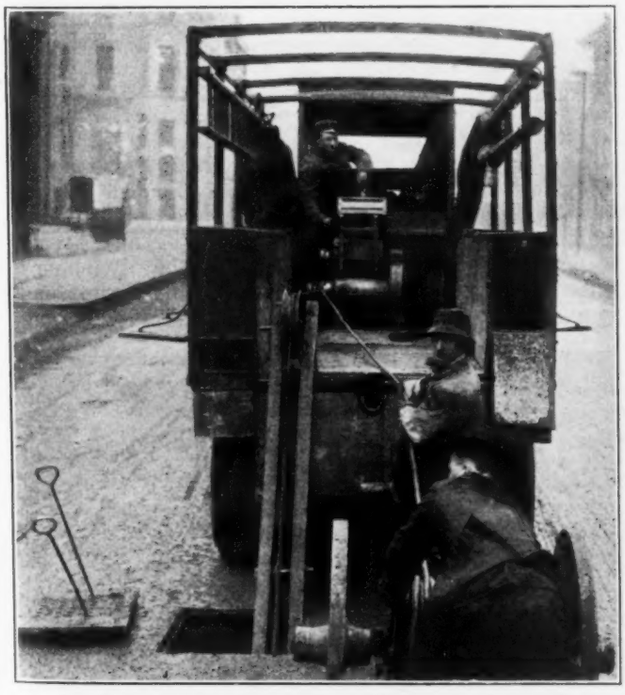
Directly behind the front seat is a motor-driven winch equipped with a friction drum on one end and a winding drum on the other. The winch motor, which is rated at 2.5 hp., 1600 r.p.m., and 80 volt, is connected to the winch through double-reduction gears and is capable of pulling in cable at the rate of 15 to 30 ft. a minute, depending on the nature of the duct run. The motor is controlled from a small panelboard installed in a slanting position behind the driver's seat. On the panel is mounted a double-throw switch for reversing the direction of rotation and a speed-control rheostat. A hand brake for retarding the pulling-in mechanism is also conveniently placed near the driver's seat, the driver simply turning around in his seat to operate the winch.

The friction drum is used entirely for pulling in cable. One man stands on or near the rear of the truck, and with four or five wraps of the rope around this drum takes up the rope as fast as it is wound in, and is able to control the speed of pulling in by the amount he allows the rope to slip. This method gives double safety, for either this man can stop pulling on signal by "slacking off" his rope, or the driver can stop by pulling the switch in the motor circuit. A hole is provided in the floor directly under the friction drum, through which cable may be pulled at special manholes, tunnel shafts, etc. The winding drum is used for loading reels of cable onto the truck or for unloading them. In this operation one end of a rope is fastened on the drum, the rope looped around the reel and the other end hooked to the truck bottom. As the rope is wound on the drum, the reel of cable is rolled up the skids.

Some of the Boston company's trucks have been equipped with power winches, to permit loading cable reels and other pulling operations. With these trucks only two men are required to load reels, whereas under ordinary conditions with a horse-drawn truck and no power winch about ten men would be required to perform the same operation. These trucks are also used extensively on long-haul trips out-of-town and in pick-up work at railroad, freight and express stations at Boston, thereby saving local express charges.

For handling transformers the Pacific Gas & Electric Company has devised a frame carrying a small crane rail that can be set on trucks with the pole uprights fitting into suitable recesses on each side of the platform. The rail is supported about 8 to 9 ft. above the platform of the truck and extends several feet beyond one end so a 2.5-ton triplex block can be used to lift the transformer off from the truck platform and convey it to the rear where it may be lowered into a manhole. This frame can be easily removed from the truck and left in storage when not required.

Two pump wagons are employed by the Boston company for taking care of all manholes in its system, the total being about 8000. In 1915 these wagons pumped about 5,461,000 gal. out of manholes, 15,000 openings being made. It may be pointed out that the company endeavors to open every manhole at least once a year throughout the approximate 700 square miles of its territory. The outfit is also used for washing out manholes. One of these pump wagons is illustrated herewith pumping water from a manhole into the sewer. It is equipped with a 2-hp., 85-volt d.c. motor, direct connected to a centrifugal pump, which is capable of raising 75 gal. per minute with an approximate suction



COMMONWEALTH EDISON TRUCK PULLING CABLE

lift of 20 ft. The wagon carries 21 ft. of 3-in. suction hose and 30 ft. of 2.5-in. discharge hose. The motors are operated by the vehicle battery.

For making breakdown tests on cables and transformers and conducting ratio and core-loss tests on transformers in substations, the Edison Electric Illuminating Company of Boston is employing portable equipment, which is carried on two trucks coupled together by a drawbar and pivoted link. Only the first truck, which is a General Vehicle gasoline truck, is employed to produce tractive effort, the second vehicle being only a trailer. The drawbar is connected with a steering mechanism of the trailer so the latter is automatically steered from the forward chauffeur's seat. The power truck carries a 100-hp. motor generator set with a starting compensator having a range of 2300 to 4000 volts,

BOSTON EDISON TRUCK ERECTING POLE

a 100-kw. 2200-volt generator, one switchboard, an instrument stand with a felt base, switches, cable and the like. The rear truck carries an air-cooled, 800-kva. transformer, an 850-kva. reactor to balance the capacity of the testing cable, current and potential transformers and two motor-driven blowers for cooling the transformer and reactor. The maximum pressure obtainable from the transformer is 30,000 volts.

The combined power truck and trailer weighs 19 tons and is 47 ft. long over all. The power truck chassis is equipped with towing rings so the trailer drawbar can be removed for chain towing in dead-end alleys and substation yards, as it is not feasible to back the truck and trailer except for short distances in a straight line. Steering and braking of the trailer is performed by the assistant on the trailer when it is being towed by chain. Between the front and rear truck is a bell signal system employed to acquaint the chauffeurs with each other's movements. Provision is made so that the truck can be disconnected quickly. The total cost was about $25,000.

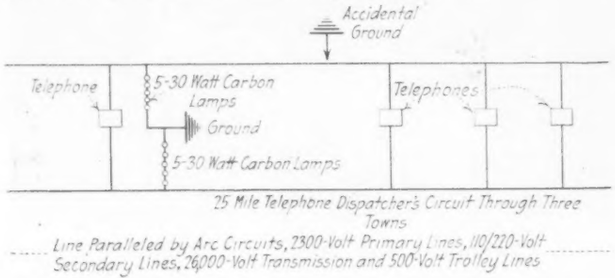
The Pacific Gas & Electric Company also uses trucks for heavy construction work, underground repair work, cable pulling and reel loading. The construction truck is a 2-ton vehicle equipped with extension ladders, Prest-O-Lite heating equipment and a long box subdivided into compartments for holding small tools, etc. The underground repair truck is a 1-ton General Motors storage-battery vehicle. It is equipped with two Prest-O-Lite tanks which are mounted inside at the rear and are used for rapidly heating solder and wiping lead joints. One tank is equipped with a burner which replaces the old gasoline blow torch, and the other has a simple tip for a hot flame. The cable pulling truck is a 3.5-ton storage-battery vehicle equipped with a motor-driven winch.

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Method of Improving Service and Protecting Dispatcher's Telephone Line

At the home office end of a 25-mile telephone dispatching circuit, the Benton Harbor & St. Joseph (Mich.) Railway & Light Company has installed two banks of 30-watt carbon filament lamps and has connected the lamp banks into the telephone circuit as shown in the accompanying diagram. One extremity of each bank is connected to a leg of the telephone circuit and the opposite ends of the banks are connected to a single ground. These two series lamp banks provide paths of high resistance through which induced currents caused by high potential paralleling lines can flow to ground. Relieving the line of these stray currents reduces line noise and thus improves service.

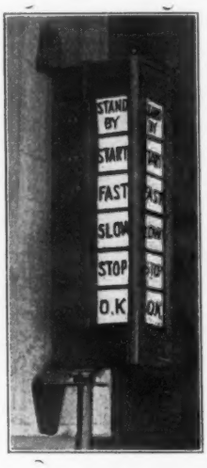

Accidental Ground
Telephone
5-30 Watt Carbon Lamps
Ground
Telephones
5-30 Watt Carbon Lamps
25 Mile Telephone Dispatcher's Circuit Through Three Towns
Line Paralleled by Arc Circuits, 2300-Volt Primary Lines, 110/220-Volt Secondary Lines, 26000-Volt Transmission and 500-Volt Trolley Lines

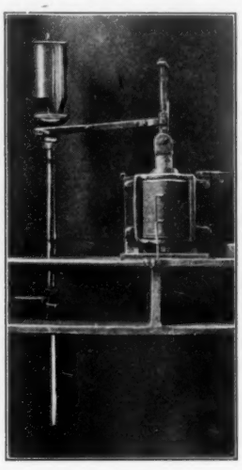
LAMP BANKS USED TO REDUCE TELEPHONE LINE NOISE

If the telephone line is rendered very noisy by an accidental ground on one side, service can be temporarily improved while linemen hunt the trouble by loosening in its socket one of the lamps in the bank nearest the accidental ground. Should the telephone line accidentally come into contact with the 500-volt trolley line, as sometimes happens in interurban service, the current from the trolley takes the path through the lamps to ground and does not harm the instruments on the telephone circuit. At such times the lamps glow and inform the dispatcher of trouble.

Signaling Devices Used in Pennsylvania Central Station

A signaling system consisting of illuminated signal boxes and solenoid operated whistles controlled by the switchboard operator is employed at the Holtwood Station of the Pennsylvania Water & Power Company to transmit orders regarding the manipulation of generators. The signal boxes, one of which is shown herewith, are installed on the engine room wall opposite each generator where they can be easily seen by the governor attendant. Each box is divided into six compartments, each containing an electric lamp and having glass windows on the front and sides. On these windows are painted the signals, "Stand by," "Start," "Fast," "Slow," "Stop" and "O. K." To facilitate reading these signals at a distance different colored lamps are used inside the compartments. For example, the "Stand by" lamp is blue, the "Fast," red, the "Slow," green, and the others white. Push-button switches are provided on this box so operators can acknowledge signals, but they are used only for test purposes, since replying to a signal delays the attendant several seconds. Duplicate signal boxes, connected in parallel with those already mentioned are installed on the exciters, which are below the generator floor, for emergency use when the gov-





FIGS. 1 AND 2—ILLUMINATED SIGNAL BOX AND SOLENOID OPERATED WHISTLE

ernor and hand control on the generator floor are out of service and the exciter turbines must be controlled from the lower floor.

These signal boxes are controlled from gang switches located on the corresponding generator panels of the main switchboard. The electrical connections are indicated in the accompanying line drawing and one of the gang control switches in Fig. 3. The pilot lamps light on the gang switch when a button is pushed and are extinguished by the attendant at the corresponding

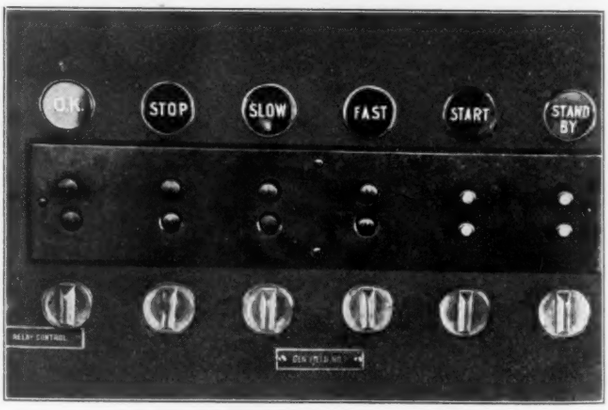


FIG. 3—GANG CONTROL SWITCH WITH PILOT LAMPS

machine acknowledging the signal or by the switchboard operator returning the control switch to its former position. Multi-conductor cable inclosed in conduit is used for connecting the control switches and signals.

One of the electrically controlled whistles previously mentioned is located at one end of the powerhouse and

is loud enough to be heard in spite of the noise of the machinery in all parts of the building and for quite a distance outside. It is used principally for calling persons connected with the plant operation, but also used to advise operators to "hold the frequency" or "stand by" for emergencies. This whistle is operated by compressed air at 300-lb. pressure. Another emergency whistle is located on the roof of the station for calling assistance during operating emergencies and for summoning

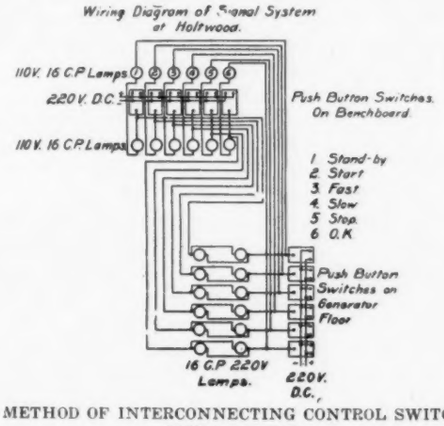


FIG. 4—METHOD OF INTERCONNECTING CONTROL SWITCHES AND SIGNAL BOXES

operating heads and physicians when they cannot be located by telephone. The whistle can be heard 5 to 6 miles away.

Production Cost in a 20,000-Kw. Massachusetts Central Station

During the year ending June 30, 1916, electrical energy was produced at a net cost of 7.9 mills per kilowatt-hour in the steam turbine plant of the Worcester (Mass.) Electric Light Company, according to data filed with the Massachusetts Gas and Electric Light Commission. Worcester is an inland city with numerous manufacturing plants turning out diversified products, and the price of coal is relatively high. During the above period the company burned 40,512 tons of bituminous coal, the average cost being $4.28 per ton. The total output of the company's steam generating equipment was 32,735,730 kw.-hr.; the maximum load during the year was 10,900 kw., and the station load factor for the year was 34.3 per cent.

NET PRODUCTION COST (STATION OPERATING EXPENSES ONLY) FOR 1916, OF WORCESTER ELECTRIC LIGHT COMPANY

Coal, 40,512 tons	$173,415
Oil, waste and packing	1,104
Water	1,303
Wages at station	36,754
Station tools, etc.	8,062
Station structural repairs	14,185
Steam plant repairs	15,787
Electric plant repairs	5,770
Miscellaneous	1,815
Total station operation	$258,195

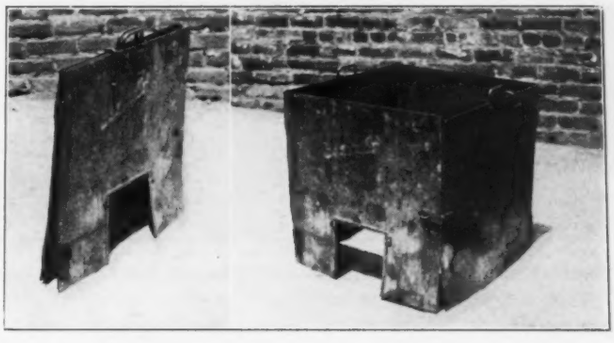
The coal consumption per kilowatt-hour was 2.77 lb. average for the year. The unit cost of production was 7.9 mills per kilowatt-hour, of which 5.3 mills was fuel cost and 1.12 mills operating labor cost.

Practically all the energy generated by the company was produced in its recently built Webster Street turbine station, a thoroughly modern plant equipped with 18,500 kw. in generating units and ten water-tube boilers with a combined rating of 7500 hp. There are two 6250-kw. turbo-generators and three 2000-kw. units, all Westinghouse horizontal type machines. Two 700-hp. Edgemoor, two 1250-hp. Bigelow-Hornsby and six 600-hp. Stirling boilers, all fired by mechanical stokers, are in service, and condensing water is taken from an adjacent pond. Feed water is drawn from the condenser overflow. Two Le Blanc and three Wheeler jet condensers are in service. At Faraday Street station, about 3.5 miles distant, a 1500-kw. vertical Curtis turbo-generator and four 250-hp. Stewart return tubular hand-fired boilers are held in reserve.

The maximum load carried by the company occurred on June 16, 1916, instead of in the orthodox Christmas season. The peak on this date was 10,900 kw., varying from 8500 to the peak value from 7 a. m. to 6 p. m. The load factor for the maximum day was 56.3 per cent, and the influence of the power load on the shape of the output curve is marked by two towering peaks, one for forenoon and one for afternoon operation. The average twenty-four-hour load for the entire year was 3740 kw., or roughly 23 watts per capita.

Windshield for Furnace Used by Cable Crews

The street department of the Commonwealth Edison Company has adopted sheet steel windshields, such as shown in the accompanying illustration, as a part of the standard equipment of cable gangs. These shields consist of four pieces of No. 18 gage sheet steel, 24 in. square, hinged together to fold into a flat piece, as shown, when not in use. When folded up a clip riveted to one piece keeps the shield from opening up when carried. When set up for use, a hinge lock holds the two free edges in place, and handles on the top edge make it easy to lift the shield up away from the furnace or to shift its position. When folded, these handles come together to make a single handle for carrying. One side has a 10-in. by 10-in. opening at the bottom, through which the furnace may be regulated instead of having to reach in from the top and encounter the intensive heat. The edges of this opening are reinforced with metal strips riveted in place. The device is inexpensive, saves gasoline and prevents accidents from using inflammable windshields.



FURNACE WINDSHIELD IN CLOSED AND OPEN POSITIONS

Disadvantages of Screen Type Manhole Guards

BY G. H. MCKELWAY

In the Aug. 12 issue of the ELECTRICAL WORLD, page 325, descriptions of two types of manhole guards used by a large city lighting company were published. One of these consisted of an angle-iron frame surrounding the hole, and the other, which it was stated is used only where the traffic is light, consisted of a wire grating fitting into the manhole head flush with the surface of the street. The question of using guards similar to the second type was once brought before a safety committee of the employees of another large company oper-

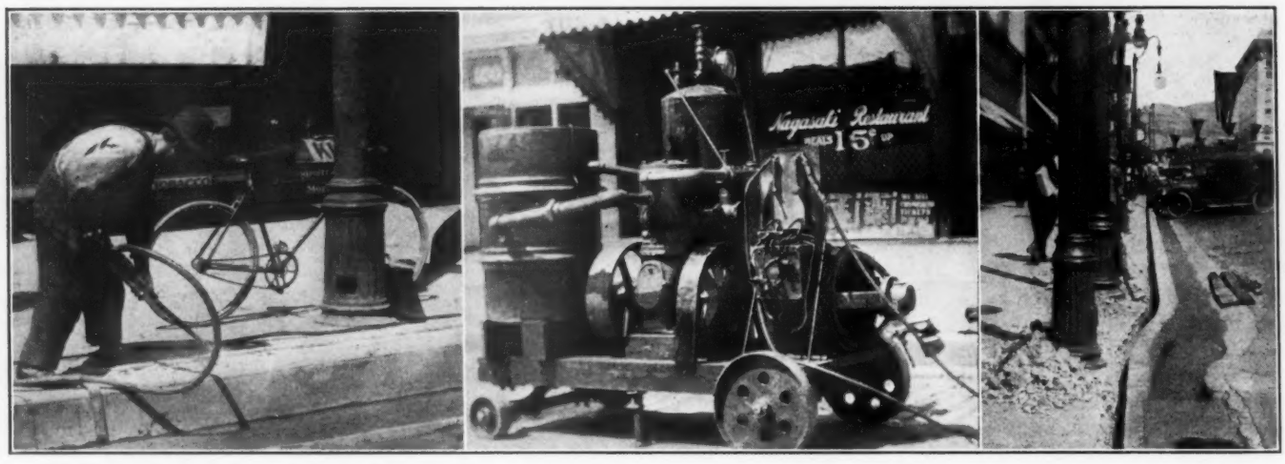
ating an extensive underground system, and the decision reached that such guards would not be used.

The principal argument in favor of the adoption of the guards was that they would insure the safety of the men in the hole in case the standing guard was knocked down by a runaway team or by a piece of fire apparatus. On the other hand the statement was made that the guard when in use would interfere with the passing up or down of tools, solder, etc. Most important of all, it would interfere with the ability of the splicer in the hole to escape quickly if one of the cables should break down. This argument was thought to outweigh the favorable features and the recommendation to use this type of guard was turned down.

The splicers of the company last referred to are always accompanied by helpers, who stay on the ground near the hole at all times, where they are in a position to prevent anyone from accidentally stepping into the hole, which is one of the functions of the guard to which reference is made.

Method of Cutting Trench for Street Lighting Cables

To facilitate making trenches in sidewalks next to the curbs in which to lay street lamp circuits the Utah Power & Light Company, Salt Lake City, is employing an Oldham pneumatic air jack-hammer and a portable motor-driven air compressor operated from trolley circuits. The equipment and a cable trench made with this apparatus are shown in an accompanying illustration.



PNEUMATIC HAMMER DRILL AND PORTABLE AIR COMPRESSOR OUTFIT USED TO DIG TRENCHES SUCH AS SHOWN AT THE RIGHT IN THE ILLUSTRATION

The compressor is gear connected with a 7.5-hp., 500-volt, direct-current motor. Mounted on a vertical panel next to the motor are the fused service switch and starting box. The meter for measuring the energy consumed is mounted on a separate support so that it may be set up next to the portable compressor but will not be subjected to the vibration of the latter. According to records the energy consumption has been 0.182 kw.-hr. per linear foot of trench. This value is based on 670 ft. of 4-in. trench cut in concrete 4 in. thick. One mechanic is employed to supervise the operation of the compressor while a helper operates the pneumatic hammer. About 108 ft. of trench can be cut in a day of 8 hours with this apparatus.

The same equipment has been used for other concrete chipping jobs the most extensive of which was probably along the St. Paul railroad where a 6-in. by 10-in. trench had to be cut in concrete for relaying tracks. On this job, it was estimated that the labor of ten men, equivalent to about $17 a day, was eliminated.

INEXPENSIVE RURAL TRANSMISSION LINE

Economic Features of 2400-Volt Transmission Line Construction to Serve Near-by Towns Containing Less Than 2000 Population

BY H. H. FENTON

Many companies hesitate about extending lines to near-by towns of less than 2000 population, thinking that high-voltage transmission which involves relatively costly construction will be required. For the same reason it is difficult to get these small communities to finance the building of these lines. The mistake lies in believing that high-tension lines are always required. Where the transmission distance is only 4 or 5 miles 2300-volt primary distribution lines can be extended and operated satisfactorily. For example, at Blue Rapids, Kan., the Marshall County Power & Light Company had an excellent day load, consisting of plaster mills and the like, but the evening load was poor. In an attempt to develop this load, proposals were sent to neighboring towns to secure lighting business. Since Waterville, one of the communities which had been solicited, had a municipal plant which was operating only from dark to midnight the citizens entertained the proposal with hopes of dispensing with the local plant and securing twenty-four-hour service. When the subject of who should build the line was discussed, however, neither company nor the town was eager to invest the money necessary to construct a 22,000-volt line, which was then considered. The outcome was that the electric service company offered to erect a 2300-volt three-phase line, consisting of No. 6 bare copper wire, mounted on 25-ft. and 30-ft. poles, and measure energy delivered at the Waterville switchboard.

While some misgivings were felt regarding the economy of employing so low a voltage, the line was built nevertheless. No ground wires or transpositions were made. The line, which was 4.95 miles long, was completed in nineteen days at a cost of $2,225.03, or $449.50 per mile. When the load was connected the line drop was found to be only 80 to 90 volts. The generator voltage at Blue Rapids was therefore raised to 2400 volts so that 2300 volts would be available at the delivery end.

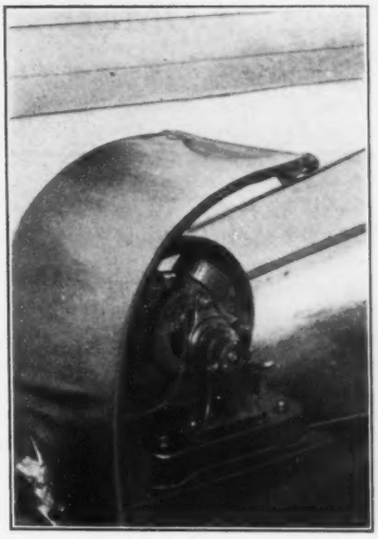
This extension required no step-up and step-down transformers, and no high-voltage insulators and special construction. The return on the investment can be judged from the following records, which cover ten months' operation. The maximum demand was not

over 35 kw., with the energy consumption for ten months 33,319 kw.-hr. The highest one-month consumption was 4275 kw.-hr. and the lowest 2442 kw.-hr. The average income per month was $166.59, the rate being 5 cents per kilowatt-hour straight. This, as may be readily seen, allows for interest, depreciation, taxes, maintenance and a fair balance for profit. It is estimated that two years of net earnings will pay off the loan required for building the line. With such a guarantee any utility should be able to secure loans for small but desirable loads.

In addition to supplying energy to Waterville, the Marshall County Power & Light Company also serves Marysville and Blue Rapids, the town in which the plant is situated. At the latter place two mills of the American Cement Plaster Company are operated. The generating equipment consists of three 150-kw. General Electric generators, one of which is a horizontal unit geared to two 35-in. vertical McCormick water wheels. The other two units are of the umbrella type, each being driven by one 50-in. vertical Sampson wheel, to which it is directly connected. The wheels operate under a head of approximately 11.5 ft., the older type generator running at 514 r.p.m. and the two newer ones at 120 r.p.m. The night load requires the operation of only two of the generators, while the day load, which is greater, due to the cement mills operating, calls for three generators.

Home-Made Oil Shield for an Exciter

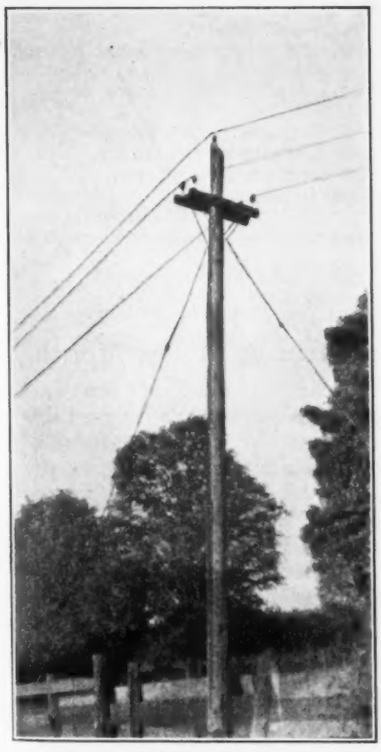
A belt-driven exciter in the power plant of the Chatam (Mass.) Bars Inn has been provided with an oil shield at nominal expense. As shown in the accompanying halftone, the shield consists of a canvas top of the grade generally employed in automobile furnishings. It is mounted on a U-frame of 0.5-in. pipe, 30 in. high and 22 in. wide. Two floor plates provide the requisite attachment for the base of the structure and two elbows carry the top cross piece, the canvas being sewed around the pipe. No unions are required in this simple but effective arrangement.



OIL SHIELD MADE OF IRON PIPE AND CANVAS

Scheme for Bracing Insulator Pin at Angle in Transmission Line

On the new 2300-volt transmission line from Frankfort to Bear Lake, recently completed by the Benzie County Power Company, Frankfort, Mich., some difficulty was experienced in preventing the pole-top insulators from leaning over at serious angles from a vertical position. The equilateral triangle type of construction was used and the top wire carried on special pole-top pins, but with much side strain, these pins would not retain their vertical position. This was corrected by installing a ⅝-in. round iron brace which is looped over the insulator pin just underneath the insulator and extended down the side of the pole about 30 in. where it was securely fastened. Any tendency of the pin to pull over is thus taken up by the brace. The accompanying illustration shows an installation of the brace on an insulator pin at a point in a wood pole line where the line crosses from one side of the road to the other.



IRON BRACE INSTALLED TO HOLD INSULATOR PIN IN VERTICAL POSITION

Motor-Driven Pump as Auxiliary in Pumping Station

At station A in the sewerage pumping system of the New Orleans (La.) Sewerage and Water Board, the increase in pumpage rate, due to the addition of services and increased mileage of the sewer system, has required a capacity in excess of that of the existing installation. The Corliss engines at this station are still in first-class condition, and would be serviceable for years to come, but the engineers of the board have found that the economy possible by operating all stations from one central plant has rendered it desirable to practically discontinue the operation of this station as a steam plant. The engine-driven pumps have required expensive repairs, new shafts having been built and installed for both the large units in service.

The pressure head at this station required to discharge the capacity of one pump into the Mississippi River requires a total lift of 56 ft. The engine speed of 125 r.p.m. cannot be safely exceeded with Corliss engines of this size, and as the present runner diameter of 11 ft. is already excessive, it did not appear practicable to increase this lift by attempting to force additional sewage through the existing 48-in. discharge line into the river with engine-driven units. The discharge capacity might have been increased by the addition of another discharge main to the river and an additional engine-driven unit, which would have cost for the 48-in. main and 70 cu. ft.-a-second unit, about $235,000.

As the existing force main is of ample capacity, except in rainy weather, and as the limitations as to lifts do not exist on an electrically driven pump, it was evident that from the view of initial outlay only an electrically driven pump would meet the case. The pump efficiency obtainable with such a unit, consisting of a 36-in. centrifugal pump and 1250-hp. motor, and the low water rate of the board's steam turbine plant, has actually enabled the capacity of the installation to be doubled and the lift consequently increased 50 per cent without requiring any additional fuel consumption per million gallons discharged. The motor-driven unit has permitted needed repairs in the station.

COMMERCIAL AND BUSINESS POLICY

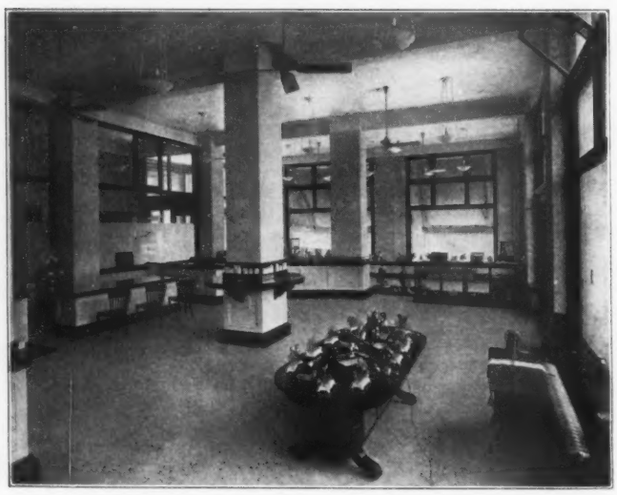
A Department of Plans and Methods for Widening the Application of Electricity and for Extending Electric Service

Dallas Electric Light & Power Company Opens New General Offices and Display Rooms

The new showrooms and offices of the Dallas (Tex.) Electric Light & Power Company in the new Interurban Building at Dallas, were thrown open to the public this month with a reception and an electric show, the first electric show to be held in the Southwest. More than 25,000 people visited the offices and inspected the various electrical appliances therein during the day and evening. E. T. Moore, manager of the Dallas lighting and railway properties, and Walter G. Ross, commercial agent of the Dallas electric company, had active charge of the opening and display of electrical devices.

The main display room of the new offices is devoted exclusively to the exhibition and sale of electrical appliances. Its 2500 sq. ft. of space is sufficient to take care of the needs of the lighting company's present 25,000 customers and to allow for expansion. The fittings are of mahogany. Fourteen large plate-glass windows separate the display room from the station waiting room, so that prospective purchasers among the interurban patrons, can see a wide variety of stock kept in faultless condition. Bordering the display room and practically a part of it are the offices of the electric company which the public visits oftenest. The cashier's office, the check counter, the lamp counter and the application counter are here. Thus two purposes are served: The location here of these "oftenest visited" departments of the light company makes them easy of access to customers and the fact that customers cannot visit them without also being attracted by the display of electrical appliances results in many who enter the building without thought of purchasing any such appliances finally becoming purchasers.

Obviously, courtesy often coaxes the casual sightseer into becoming the steady user of electrical appliances. Hence, little courtesies on the part of the display-room management are not neglected. In the display room are telephones solely for the convenience of the public and a sign over these telephones advertising that fact. Throughout the room, for the special convenience of the ladies, who probably constitute the larger percentage of buyers, restful settees are placed, and iced water for the thirsty is also always on hand.



THE NEW DALLAS GENERAL OFFICE—NOTE THE COMFORTABLE CHAIRS IN FRONT OF THE APPLICATION COUNTER

Believing that familiarity with electrical appliances breeds not contempt but content with them in the home, Mr. Ross has instituted a plan of weekly demonstrations of different devices. One week is given to the demonstration of each and thus the purchasing public is gradually given intimate knowledge of how all the appliances may best be put to service and there is less likelihood of discontent of the purchaser through not knowing perfectly how to use what has been bought. One week is devoted to vacuum cleaners, another to sewing-machine motors, etc.

Company Employees as "Load Builders"

"The Load Builders," an association of employees of the Pacific Light & Power Corporation, Los Angeles, Cal., organized to assist in securing new business for the company, has adopted the following six "reasons why" to inspire its members to use every opportunity to obtain new light and power services for the company:

1. You, as an employee, want to advance to a higher position in the corporation.
2. Advancement means increased salary.
3. To pay larger salaries, the corporation must have a larger income.
4. More income depends upon a greater volume of business.
5. By helping the sales department to get more business you help yourself to a firmer foothold on the ladder.
6. Your superiors will not overlook your efforts.

Any tip of any sort leading to new or additional business puts you on the roll of "live ones." Send them in while they are fresh—through your boss or direct to the sales department.

Be a "load builder."

Electric Ranges for Rent at $1 Per Month

The Northwestern Electric Company of Portland, Ore., has developed considerable electric-range business by offering to rent ranges for a first payment of $10 down, to help pay installation costs, and $1 per month thereafter. The purpose is not to rent ranges so much as to interest prospective customers and reassure them on the point that the central station has confidence in the performance and serviceability of the ranges. No electric ranges have been rented to date, the several customers who came in to learn more about the offer having all purchased ranges on the installment plan.

The matter of outright purchase has been made easy through an arrangement whereby the usual terms of installment sale have been somewhat reduced. Coupons were issued and sent to 10,000 consumers with the announcement that each would be honored at face value of $10 toward the initial payment of $13 on a certain well-known make of range. This virtually made the terms of sale $3 down and $3 per month, as the central station installs the range free. Under these terms a customer can purchase a range and use it two months

as his own for the same outlay of money as if he rented it for the same period, and since the company readily agrees to take back all ranges that do not prove satisfactory for any reason, the customer invariably sees an advantage in buying rather than renting.

Once the range is in the kitchen there is little doubt about satisfying the customer. At the recent Seattle (Wash.) convention of the Northwest Electric Light & Power Association the representative of one manufacturer said that 99 per cent of their ranges installed remained where placed.

Garage Company at Boston Offers Vehicle-Battery Exchange Service

The D. C. Tiffany Company, 136 Chestnut Street, Boston, Mass., will shortly inaugurate a battery service for electric truck users. The company is making a specialty of light delivery wagon service and sells a Ward special chassis for $760 and a steel panel body for $120, offering a rental of the Edison "G" battery at prices ranging from $13.50 per month the first year to $11.50 per month the fifth year and thereafter. These wagons have a capacity of 750 lb. each and are geared to run 10 miles per hour. They are guaranteed to make 35 miles per charge and have attained a maximum of 58 miles at Boston. The Tiffany company maintains an electric garage at the foot of Beacon Hill in Boston and handles the Ohio pleasure electric car. The sales of electric vehicles by this agency have doubled in the past two years. A recent installation of seven 750-lb. electric delivery and collection wagons has been made to the Salem (Mass.) laundry, this being one of the largest fleets of light delivery trucks ever placed in this class of service in New England. The new battery service will be in addition to the service already offered by the Edison Electric Illuminating Company of Boston at its Atlantic Avenue garage, in co-operation with the General Vehicle and Electric Storage Battery companies.

Interesting Terms of Salem Electric Company's Contract with Large Mill Customer

About a year and a half ago one of the most important central station power contracts in New England was executed between the Salem (Mass.) Electric Lighting Company and the Naumkeag Steam Cotton Company. In the references to this ten-year contract in the ELECTRICAL WORLD of Jan. 30, 1915, page 316, emphasis was laid upon the fact that this agreement marked a distinct advance in the supply of energy to textile establishments by central stations. The contract has recently been filed by the lighting company with the Massachusetts Gas and Electric Light Commission at Boston, and in view of the fact that its fulfillment involved a substantial extension of the Salem company's generating plant and a consequent additional investment to be protected under the conditions which might arise in the future, some of the essential features of the agreement are summarized below.

From the standpoint of large central station business, the chief interest of the Naumkeag agreement lies in its flexibility. The Salem company agreed to install and maintain the necessary equipment and to hold itself in readiness to supply 4000 kw. of electrical energy to the consumer's mills, which are among the largest of their class in the New England field. Probably not far from $500,000 had to be expended by the Salem company as the result of taking over this business, considering the value of plant, which must be at the disposal of the customer.

The agreement defines the area within which the consumer desires to use energy purchased from the Salem company, thus providing a zone within which an agreed point of delivery could be reached and establishing a maximum distance of transmission, which in this case, however, was within a comparatively few hundred feet of the central station 2300-volt buses. In general, the consumer agrees to take all electrical energy used for any purpose within its establishment and in future extensions of the latter on the defined premises, but it is agreed that the consumer may maintain and use upon its premises equipment for the generation of electricity for lighting. This enables the industrial plant to take advantage of the demand for steam for heating purposes in the winter season if it so desires, and in such event may operate to restrain the peak load upon the central station if conditions require such operation.

The central station agreed to construct and maintain the necessary underground circuits to supply the consumer, but the consumer agreed to provide and maintain at its own expense all distributing circuits beyond the point of delivery. None of these, however, is to be erected or maintained by the consumer upon the public ways, a point which insures the protection of the central station's normal functions of universal supply within its territory. The company agreed to provide and maintain all power transformers, the Naumkeag organization providing all lighting transformers and lamps. The service is 2300-volt, three-phase, 60-cycle, and the allowed fluctuations in frequency and voltage are 2.5 per cent and 4 per cent respectively. No instantaneous fluctuations are considered.

METERING OF ENERGY

The Salem company agreed to furnish at the point of delivery a metering installation to indicate the demand and energy consumption in kilowatt-hours, with a check meter for the latter readings. The monthly readings of energy consumption are the average of the two watt-hour meter records, unless either meter fails to record within 2 per cent of the correct input. An initial accuracy within 1 per cent of correct under average oper-

An Electric Motor Floral Float

This huge replica of an electric motor was formed of flowers mounted on a wooden framework. The whole structure, carried appropriately on a concealed electric-vehicle body, proved one of the features of the parade in which it was exhibited.

ating conditions was required of each meter, and both watt-hour meters are tested at least once every four months, being adjusted to within 1 per cent of absolute accuracy if they are found to differ by more than 2 per cent. On any test where either meter is found to be more than 2 per cent out, a readjustment is made covering one-half the time elapsed since the last test. Meter tests are to be made whenever the consumer requests, and if the meters are found to be within 2 per cent of absolute accuracy, the consumer then bears the cost of the test.

In consideration of the lighting company's installing and maintaining the necessary equipment and holding itself in readiness to supply 4000 kw., the Naumkeag company agreed to pay (*a*) a capacity charge of $3,125 per month, and (*b*) an energy charge of 6.5 mills per kilowatt-hour. The consumer has the option of demanding a maximum input of 5250 kw., and if the demand for a given month exceeds 4000 kw., an additional capacity charge of 83.33 cents per kilowatt of excess demand is imposed. The consumer agreed to give the company reasonable notice of its intention to install electrical apparatus which would result in an increase in the maximum demand. Should the consumer be thirty days in arrears in respect to the payment of bills, the central station company may, upon three days' written notice, discontinue service and remove all its equipment on the consumer's premises. All obligations of the Salem company to supply further service under the contract then cease, and there immediately becomes due and payable to the central station as liquidated damages, and not as a penalty, all minimum charges which would have become payable during the balance of the contract term had the agreement so long remained operative. This feature is one of great interest from the standpoint of protecting the central station investment.

VARIATION IN ENERGY RATE WITH COAL PRICES

Another interesting feature is a provision for variations in the energy rate provided the cost of coal rises or falls above stated limits. The rates quoted above are based on a coal cost of $4.05 per gross ton of 2240 lb. delivered at the central station company's crusher. If at any time during the continuance of the contract the Salem company pays for coal of approximately 14,600 B.t.u. of Pocahontas or New River quality $4.30 or more per gross ton, the Naumkeag company agrees to pay an additional amount for each kilowatt-hour of energy used equal to the actual increased fuel cost per kilowatt-hour to the central station company, as shown by the latter's production records, over and above what the cost would have been had coal of similar quality been purchased at the $4.05 rate. A corresponding reduction is to be made in case the cost of coal reaches $3.80 or less.

Provision for improvement of power factor in case of necessity is made by the consumer's agreement that the power factor of its load shall be such that the company shall not be required to furnish more than 1.25 kva. for each kilowatt of demand (equivalent to 80 per cent power factor). If the power factor is found on test to be below 75 per cent (barring instantaneous indications) the Naumkeag company agrees to install equipment necessary to bring it back to 80 per cent minimum. Housings and supports for transformers, meters, etc., are provided by the consumer. The central station company does not guarantee a constant supply of electricity, and is not held liable in damages for failure or interruption of the supply at any time, but all interruptions continuing for twelve or more consecutive hours are to be held to justify a pro-rata reduction in the capacity charge.

Wiring and Illumination

Latest Practice in the Electrical Contracting Field and in the Art of Interior and Exterior Illumination

Fixture Selection and Maintenance in Office Building Lighting

Aside from certain economies practised in office building lighting that appear directly on the expense records, there are others which, though not always effecting a decrease in expense, result in better quality and quantity of illumination; in pleased tenants; and finally, for the owner, in a better scale of rentals, and a higher interest on the investment.

Some of the results of studies of office lighting economics were discussed in the paper by S. G. Hibben of the Westinghouse company, Pittsburgh, Pa., presented before the Illuminating Engineering Society on Sept. 20. Starting with the planning of a large office building, one of the first possible economies may be realized, said Mr. Hibben, by a careful location of the outlets. This planning is more important in office buildings than in other structures, such as stores or factories, because of the necessity of providing arrangements, (1) to centralize power feeders, and have all main and branch circuits accessible, and (2) to anticipate subdivision of office space, and allow for the most flexible arrangements of different illuminated areas per unit.

CENTRALIZING FEEDERS

Naturally, it is advantageous to group the long, vertical runs of feeders in a shaft, and place this shaft at the "center of gravity" of the lighting load of the average floor. It is also virtually impossible to change long runs of branch circuits where, in fireproof construction,

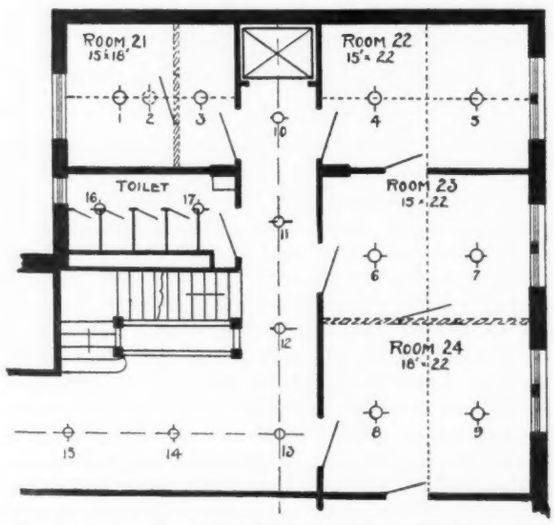


FIG. 1—TYPICAL OFFICE-BUILDING LAYOUT, SHOWING LOCATION OF FIXTURES

the conduit is laid in concrete beneath marble or fine woodwork. The economic use of copper at the present high market price, for these low-voltage circuits becomes of great importance, and careful attention should be given to arrangements of balanced feeder circuits.

The second necessity, proper location of outlets for future space subdivision, may be illustrated by reference to Fig. 1. The section of the floor shown is of a

typical high office building of recent construction. Some years ago, there would have been one central ceiling outlet in each room, but consider, for instance, room 21 (Fig. 1) if equipped with unit No. 2 only. Should the tenant desire a partition to be placed as shown, which is a not uncommon subdivision, the single unit would not

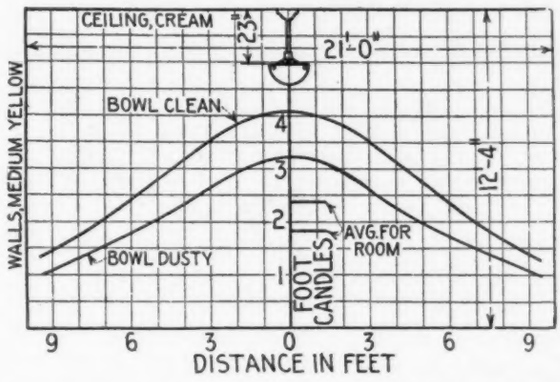


FIG. 2—EFFECT OF CLEANING BOWL UPON ILLUMINATION IN ROOM

be well placed for the larger and useless for the smaller space. Outlets Nos. 1 and 2, placed as shown, overcome this difficulty. Similarly rooms 23 and 24, either taken together or divided, will be well lighted. The tendency in modern construction is to be liberal with ceiling outlets in business offices, both for the reasons above mentioned, and to secure more illumination at the room edges than is possible from the one central fixture.

CHOICE OF FIXTURES AND GLASSWARE

The glassware and fixtures should be chosen under the supervision of an expert. How great may be the difference in intensity of illumination from different shades and reflectors is shown by tests presented by the author, in which all readings were made by the same observer and instruments, in the same size and finish of room, and with the same hanging height from ceiling to lamp filament. All glassware was cleaned and all the various units were stock samples.

With the same candle-power lamp, used with the efficient and the inefficient glassware, there is a range from 3.23 to 2.01 average foot-candles of table-top illumination. Expressed in another way, a certain semi-indirect lighting unit may be used that will supply 60 per cent more illumination at the same operating expense than another of the same style. Or if inclosing globes are considered, the maximum range is from 2.81 to 1.60 average foot-candles, where the right globe gives 75 per cent more illumination than the wrong one.

A POSSIBLE SAVING OF 60 PER CENT

Suppose that the cleaning and the first cost of the different units above mentioned be equal; and this is closely true. Then a difference of 60 per cent in the illumination means that for equal service, the unit of lower efficiency must be supplied with 60 per cent more power and 60 per cent larger lamps. Data from a typical modern office building of 168,000 sq. ft. rentable area, show the annual cost for lighting power to be $8,770, and for lamps $1,035, or a total of $9,805. Surely, then, 60 per cent of this amount, or $5,883, is a possible economy not to be neglected.

The question of the proper choice of office lighting fixtures has many ramifications, but above all else the glassware must be easy to clean. It must be sturdy and well hung, for the average night janitor has not the delicate fingers of a pianist. The metal of office fixtures should be of bronze or of equally suitable metal and since the units are often adjusted for different lengths in rooms of various heights and to suit peculiar demands of tenants, the use of chain rather than rigid stem fixtures is usually preferable.

Many little "kinks" in fixture construction eventually appear in the operating expense—for instance, whether the lamp may be unscrewed without removing the glass from the supports, or of a small hole drilled in the bottom of a semi-indirect bowl to allow the insertion of a finger so that the janitor may safely support the bowl with one hand.

CLEANING COSTS

Cleaning cost is susceptible to marked economies, and is usually the most difficult to study concretely. In order to note the importance of cleaning of lighting glassware, consider Fig. 2, illustrating a not unusual case in which the author, during the investigation of the system of one large office building, removed a semi-indirect bowl, washed it, and immediately repeated an illumination test with results as shown. The average illumination for the entire room was increased 30 per cent.

Among examples of cleaning experience, the author has collected data upon two buildings, shown in the accompanying table.

These may probably be taken as two extremes of expense. The average period of cleaning for good service, especially of the semi-indirect glass bowls, is once monthly. This period, of course, will vary with the location. The author in one investigation found that it required four and one-half minutes to remove a semi-indirect glass bowl from a fixture, scrub, dry, and replace it. To shift from one unit to another probably would double this time. These figures are for specific

TABLE I—COST OF CLEANING FIXTURES

	Building A	Building B
Number of rooms	250	.....
Number of fixtures	350	900
Cleaning period	4 weeks	3 weeks
Routine	Scrubbing	Alternate wash and dust
Janitor's salary	$675.00	$720.00
Janitor's supplies	200.00	250.00
Total	875.00	970.00
Per unit per year	$2.50	1.07
Per unit per visit	19.2 cents	6.2 cents

cases only, but they may supply the foundation for a good conception of this feature of lighting economics.

The experience of the author has led him practically to condemn the use of office lighting glassware with sand-roughed surfaces, and to hesitate in recommending the use of acid-roughed (commercially known as satin-finished) glassware.

Free Service to the New Customer Encourages Waste

"The granting of free lighting service for a limited period to such prospects becoming consumers through their acceptance of special wiring offers is generally unprofitable in the long run and is in a sense discrimination," declared E. C. Newman of the West Penn Power Company, in his paper before the Pennsylvania Electric Association at Eagles Mere Park, Pa., Sept. 7. "I contend that free service, or free anything encourages waste," he continued, "and when the new consumer begins his monthly payments for lighting service, the large number of kilowatt hours charged to his account are very apt to cause his newly installed and complete electric lighting service to later become but a trifle more productive of revenues than what might be considered as 'stand-by' service."

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

EARTH CONNECTIONS FOR TELEPHONE EXCHANGES

The Different Functions Which the Earth Connection of One Pole of the Central Battery Must Fulfill

IN the London *Electrician* of Aug. 18, 1916, W. H. Grinsted discusses in considerable detail carbon connections for telephone exchanges. He first takes up the system used for the protection of telephone circuits and apparatus against excessive pressures, etc., and then explains the uses of earth connection of one pole of the central battery.

The different functions which such an earth connection has to fulfill are not generally realized. The earth connection is usually looked upon as a means of providing a return circuit for signaling currents. In this connection it is used chiefly for completing signaling circuits on junction lines, and in some almost obsolete

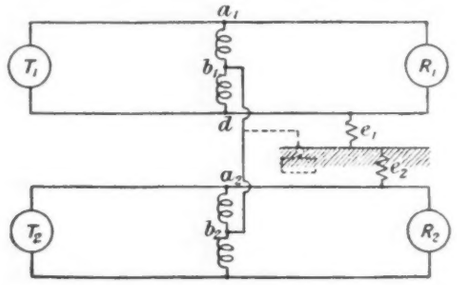


FIG. 1—TELEPHONE CIRCUIT IN SIMPLEST FORM TO PREVENT CROSS TALK AND OTHER LEAKAGE DISTURBANCES

systems for calling or clearing on subscribers' lines. It is also largely used to serve as the return for the current supply to subscribers' private branch exchange switchboards of the common battery type. On large exchanges the current supplied over earth circuit power leads for this purpose may amount to 30 to 50 amp.

There are, however, other important reasons for earthing the battery. They are enumerated as follows:

1. To reduce the number of fuses required and to avoid the need for insulating some of the return conductors. For these reasons the earth is connected to one pole of the battery and not to the center.

2. To prevent cross-talk and other disturbances due to leakage and capacity currents between the circuits connected to the central battery. As far as telephone currents are concerned, the connecting or cord circuits can be reduced to the elements shown in Fig. 1. The central battery, connected at points b_1 and b_2 can be regarded as a short-circuit for speech currents, and is not shown. Suppose the out-of-balance capacity and insulation of circuit 1 can be represented by an equivalent fault at e_1, and those of circuit 2 by an equivalent fault at e_2. Points b_1 and b_2 on the two circuits are common, being connected together at the central battery. Between points a_2 and b_2 there exists half the potential difference created by the transmitter T_2. This will cause a current to flow through the two faults as follows: From a_2 through e_2, earth e_1, d, b_1, to b_2. The circuit b_1, a_1, R_1, e_1 forms a shunt to the part of the previous circuit b_1, d, e_1, so that the receiver R_1 on circuit 1 receives part of the current from the transmitter T_2, and is disturbed by speaking, ringing or tone signals passing on circuit 2. If, however, the common points b_1 and b_2 are connected to earth the current is shunted out of circuit b_1, a, R_1, e_1, by the earth connection between the equivalent fault e_1 and the common points b_1, b_2. This connection amounts practically to a short-circuit, so that the disturbance of circuit 2 is prevented. When the number of circuits between which such interaction is possible is considered it will be seen that the earth connection plays a very important part in securing a "quiet" exchange system. These considerations show also one reason why the earth connection should be of as low resistance as possible.

3. To insure prompt indication of faults and assist in locating them.

4. To insure a reliable engaged test on the multiple jacks. The wiring and apparatus in circuit with the operator's receiver, and that in circuit with the multiple jacks, each have a certain not inconsiderable capacity, and a certain leakage or insulation resistance to earth. Other circuits connected to the opposite pole of the

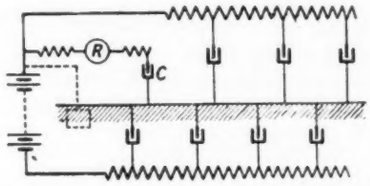


FIG. 2—ARRANGEMENT OF TELEPHONE OPERATOR'S TESTING CIRCUITS

battery have also similar capacities and leakage resistances to earth. With an unearthed battery each side of the system thus takes up a potential relative to the earth determined by the respective capacities and leakage resistances of the apparatus wiring and lines connected to either pole of the battery. The amount of apparatus, wiring and lines connected up is constantly varying, so that the potential of the poles of the battery relative to the earth will be continually changing. Included in the apparatus and wiring of the positive side are the operator's testing circuits, as shown in Fig. 2. The wiring of these circuits will possess a certain capacity to earth, e, the charge in which will depend upon the potential of the positive pole of the battery relative to earth. As this fluctuates, the capacity e will charge and discharge through the operator's receiver, giving rise to clicks, which will tend to invalidate the real engaged clicks. By connecting the battery to earth all disconnected circuits are caused to take up a definite potential with respect to earth, namely, that of that battery pole to which they are connected (provided their insulation resistance is reasonably high), so that no fluctuations in the charge on the testing circuits, wiring, etc., can be caused.

5. To assist in identifying wires in outside lines or in distance exchanges.

In telephone exchanges, contrary to the practice on traction systems, the earthed pole is almost always the positive. This insures that the whole of the lines and

apparatus which differ in potential from the earth are negative to the latter, so that any leakage currents that exist flow from earth toward the apparatus. Were the opposite the case, the line wires, and particularly the coil windings connected to the free pole of the battery, would be positive to the earth, and so suffer corrosion from leakage currents.

A second reason for earthing the positive pole is that partial earth faults show up more definitely on test when the conductor is negative to the surroundings. When its potential is positive, the fault is liable to seal up, owing to oxidation of the conductor. Some notes on the best methods of constructing the earth connections are added.

Traction

Tramway Transit and Comfort.—W. TUKE ROBSON.—A long abstract of a paper read before the (British) Tramways and Light Railways Association in London. The author points out that "the passenger has not always been sufficiently considered in the prosperous times of the past. He has had a cheap ride, it is true, but not always a comfortable one." An account is given of the extended discussion which followed.—London *Electrician,* July 7, 1916.

Electrophysics and Magnetism

Graphic Determination of Hysteresis Loss.—A. CASTEX.—The Steinmetz formula for hysteresis loss when iron is subjected to cyclic magnetic changes, is $P = \eta f B_o^{1.6} 10^{-4}$, where P represents the loss in watts per cubic centimeter, f the frequency in cycles per second, B_o the maximum value of the induction in C. G. S. units, and η the Steinmetz coefficient. Owing to the fractional index it is necessary to use logarithms in calculating the loss, and this renders the calculation somewhat tedious. This may be avoided by a new application of nomographic methods of great generality as shown by Prof. M. d'Ocagne. In order to construct the diagram of Fig. 3 successive values of f, B_o, η and P are calculated, and marked on the lines. The first three start from the origin chosen arbitrarily, and the fourth is put in place by means of two alignments corresponding to the values given f, B, η, for which one has previously calculated the value of P. In this way the scales shown in the figure have been obtained, the range of scales being such that they apply to practical cases occurring in manufacture. Suppose, for example, one wishes to find the loss corresponding to a given frequency and induction. On the *abac* is placed a piece of tracing paper or transparent sheet, on which has previously been drawn a line which passes through the points of the scales corresponding to η and B_o. The hinge is thus cut by the line at a certain point which serves as pivot, and one places the point of a pencil there; for a second alignment the position is determined by turning the line until it passes through the figure f of the frequency scale, the reading on P giving the value of the loss. These operations are indicated diagramatically by the small figure in the bottom of the left-hand corner in the diagram. When the diagram is used with a little care there is practically very little difference between the results obtained by it, and those obtained by calculation. This accuracy is uniform over the whole extent of the scale, and quite sufficient for practical requirements. Too great an accuracy need not be looked for, since the initial formula itself is only approximate.—London *Electrician,* July 14, 1916.

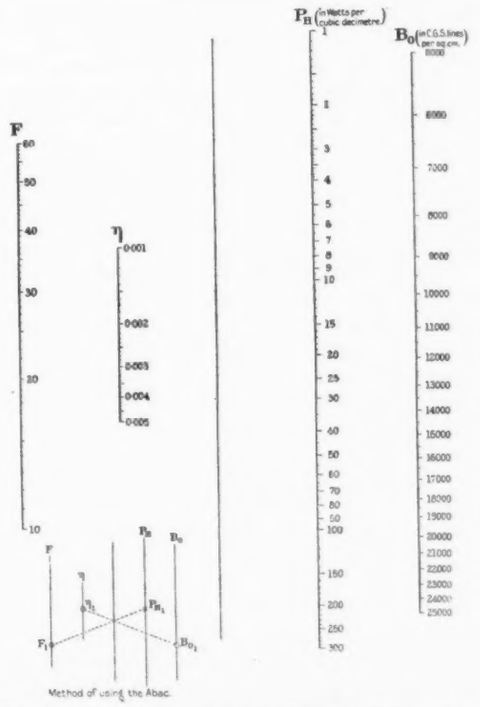


FIG. 3—CHART FOR DETERMINING HYSTERESIS LOSS

Initial Condition of the Corona Discharge with Direct Current.—JAKOB KUNZ.—A description of the numerous phenomena which are connected with the direct-current corona. The difference between positive and negative electricity appears in electrical, optical, mechanical, and probably chemical, effects. A new attempt at an explanation of some of the relations disclosed by experiments is made. Relations between the critical electric force at the surface of the wire, the pressure of the air, and the radius of the wire are obtained. The constants in these relations are different for the positive and the negative wire. The principle of conservation of energy is applied to the ionization pressure and it is predicted that over a certain range the current should be directly proportional to the pressure increase.—*Phys. Rev.,* July, 1916.

Installations, Systems and Appliances

Lifting Magnets.—An illustrated article in which detailed particulars of operating costs and performance of lifting magnets are given. These are followed by descriptions of various types of lifting magnets. Method of control and connections are next dealt with, and several safety devices of European continental origin are described. Illustrations are given of a crab provided with magnet and tongs for handling cold and hot ingots, and in conclusion reference is made to a magnet scrap-loading plant.—London *Electrician,* Aug. 11, 1916.

Electrochemistry and Batteries

Migration of Ions.—S. W. J. SMITH.—In a paper read before the Physical Society the author points out the difficulties inherent in the usual explanatory diagram. Experiments are referred to and a new diagram of ionic migration is proposed. The diagrams show plainly that ionized molecules of a salt must be fed into the current stream at the electrodes in order to keep it going, this being the essential feature of the phenomenon that the usual diagram omits.—London *Electrician,* July 14, 1916.

Units, Measurements and Instruments

The Black Body at the Melting Point of Platinum as a Fixed Point in Photometry.—HERBERT E. IVES.—Violle has proposed that the unit of light should be the amount of light given out by unit area of platinum at its melting point. Waidner and Burgess have pro-

posed a notable improvement on the Violle standard. They suggested that instead of taking the platinum surface as the light source, a black body at the temperature of melting platinum be substituted. But such a standard would still be subject to the criticism that it would have no logical connection with any other in physics. Instead of making the amount of light emitted under their conditions the unit, he suggests that it be used as a fixed point in a luminosity scale, preferably that scale whose unit is the watt of luminous flux. All of the peculiar advantages of platinum in this connection—its high melting point, its freedom from oxidation and its consequent definiteness of melting point, the purity with which it may be prepared—are really arguments for its use as a fixed point. They are so interpreted in thermometry. There is no more reason why the light from melting platinum should be taken as a unit than there is for calling the melting point of platinum the zero of the temperature scale. The author calls attention to the following three additional advantages of platinum. These points are, first, that the amount of luminous radiation from a black body can be accurately calculated by the use of constants whose values are, or soon will be, established with the highest accuracy; second, that the color of the black body at this temperature is that of the present standards; third, that the method of constructing a black body by using wedges of thin metal promises to make this proposal more generally feasible than it was at the time of its original publication.—*Phys. Review,* September, 1916.

Sensitivity and Magnetic Shielding Tests of a Thomson Galvanometer for Use in Radiometry.—W. W. Coblentz.—This paper described an investigation made to improve the sensitivity and design of a specialized galvanometer for use in radiometry. By using a lighter suspension in a vacuum, the sensitivity was increased tenfold. The results will be of great value in the study of stellar radiation since the recent advances in this field called for the increased sensitivity which now has been obtained. The paper gives details as to construction and results of tests.—Bureau of Standards, *Scientific Paper No.* 282.

Volume Effect in the Silver Voltameter.—E. B. Rosa and G. W. Vinal.—This is the subject of a paper which discusses a continuation of the Bureau of Standards researches on the silver voltameter which is the primary standard for the measurement of the international ampere. It has been found that when the electrolyte for the voltameter is not sufficiently pure the deposits in the large voltameters are in excess of those in the small voltameters in series with them. This phenomenon has been called the "volume effect." The present paper shows that this effect is due to the impurities of the electrolyte and not to other causes, as was thought by several previous observers. It is also shown that the effect is the same in all forms of the silver voltameter which the bureau has tested. A theory to account for the effect is given. This phenomenon affords a valuable criterion of the purity of the electrolyte used in the voltameter.—Bureau of Standards, *Scientific Paper* No. 283.

Inductance of Four-Terminal Resistance Standards.—F. B. Silsbee.—This paper deals with the inductance of electrical resistance of less than 1 ohm. New methods of measuring alternating current require small resistances in the laboratory tests. Even very small errors in a standard would introduce serious errors in resulting measurements. This represents an important and practical contribution to precision measurements.—Bureau of Standards, *Scientific Paper* No. 281.

Electrometer.—G. E. M. Jauncey and G. J. Buchner.—A note on the Parsons modification of the quadrant electrometer, giving interesting curves for the deflections of the needle when it is suspended in an unsymmetrical position.—*Phys. Review,* September, 1916.

Telegraphy, Telephony and Signals

Long-Distance and Cable Telephony.—B. S. Cohen and J. G. Hill.—The conclusion of their long illustrated paper in which the present position of long distance communication in England is reviewed, and the various factors which make for its improvement, on the one hand, and determine the losses which are at present incidental to it on the other, are examined and illustrated. The most reliable and effective method of increasing the range of long distance telephone communication, whether overhead, underground or submarine, is by loading. This device has now been tested and proved to be advantageous and reliable in the leading countries of the world, and its rapid extension is confidently anticipated. Other means of extending the range of communication, notably telephone relays and more efficient transmitting apparatus, are being closely studied and give promising results, but are not in such an advanced stage of development. It is also recognized that the reduction of transmission losses in exchanges, and subscribers' lines and stations, and the elimination of reflection may be made to play a most important part in the extension of the range of long distance communication. There can be no doubt that the combined effect of the various factors will in the not distant future result in a material increase in the range of long distance communication. To achieve that end in Europe it becomes more and more desirable that the closest co-operation between the various administrations should take place, and that technical terms and standards should, as far as possible, be the same.—London *Electrician,* Sept. 1, 1916.

Miscellaneous

Tungsten.—An editorial comment which refers to statistics gathered by the United States Geological Survey. It is shown that the tungsten production of the United States during the first six months of 1916 exceeded the production of this or any other country in any previous twelve months. The output was equivalent to about 3290 short tons of 60 per cent WO_3 concentrates, and was valued at $9,113,000. Colorado has regained first place as a tungsten producer and Boulder is again the premier district. California is second, with Nevada and Arizona following. Nearly all of the Western states reported some production. But if reports regarding a new tungsten discovery in Nevada are confirmed, Colorado and other states may be relegated to minor positions. A deposit remarkable both for its extent and grade of ore is now being developed and a concentrating mill is under construction. In addition to ore of milling grade, large quantities of shipping ore are reported. The situation in Colorado has become more stable, and operators are wisely turning their attention to the production of such finished products as ferro-tungsten, tungstic acid and metal, instead of marketing raw concentrates. Tungstic acid has been produced for some time by at least two concerns, and improved methods of treatment are reported as a result of the research that has been under way for the past year.—*Met. & Chem. Eng'ing,* Aug. 15, 1916.

Characteristics of Centrifugal Pumps and Fans.—B. W. Jones.—This is the second of a series of articles in which the author emphasizes how the different load characteristics affect the amount of control necessary in the case of centrifugal pumps and fans. A great deal of useful data are given in the form of curves and tables.—*Gen. Elec. Rev.,* Aug., 1916.

RAY PALMER

Men of the Industry

Changes in Personnel and Position—Biographical Notes

Ray Palmer, who has just been appointed president and general manager of the New York & Queens Electric Light & Power Company, with headquarters at Long Island City, N. Y., was formerly commissioner of gas and electricity for the city of Chicago, where during his three-year term of office he designed and supervised the construction of the city's $4,000,000 lighting system, replacing old-style arc lamps with modern tungsten-filament units. Mr. Palmer is a graduate of the University of Wisconsin and was later connected with J. G. White & Company in New York and in their London, England, office. Returning to America after several years spent in London as electrical engineer for the company he accepted a position at Chicago as electrical engineer for the Union Traction Company. From this he resigned in 1906 to take up practice as a consulting electrical engineer in Chicago and Milwaukee until 1912, when he was appointed commissioner of gas and electricity for Chicago by Mayor Harrison. Mr. Palmer resigned from that office in August of last year, and was appointed vice-president and general manager of the New York & Queens Company in November, 1915.

C. N. Stannard, secretary of the Denver Gas & Electric Light Company, has been appointed to the committee on traction matters of the Denver Civic Association.

Dean Treat, formerly assistant general manager of the Wisconsin Public Service Company at Green Bay, Wis., has been appointed general manager of the Wisconsin Railway & Light Company at LaCrosse, Wis.

Albert J. Goedgen, who was formerly electrical engineer for the Merchants' Heat & Light Company, Indianapolis, Ind., has been appointed assistant general manager of the Wisconsin Public Service Company, Green Bay, Wis.

P. H. Stambaugh, formerly power sales engineer for the Mahoning & Shenango Railway & Light Company of Youngstown, Ohio, has resigned to enter the sales and engineering department of the Petroleum Iron Works Company of Sharon, Pa.

Clarence H. Nichols, who has been with the Federal Light & Traction Company, New York City, since February, 1913, has succeeded Winfield A. Haller as general superintendent and chief engineer of that company. Mr. Nichols has been connected with the electrical industry for twenty-five years, part of this time being spent with Sanderson & Porter and part with the J. G. White Engineering Corporation.

Harold V. Bozell has been appointed assistant professor in the electrical engineering department of the Sheffield Scientific School of Yale University, New Haven, Conn., for the coming college year for which period he has secured leave of absence from the University of Oklahoma, where he has been director of the school of electrical engineering and professor of electrical engineering. Professor Bozell is a graduate, with a later professional degree, from the University of Kansas. For the past eight years he has been connected with the University of Oklahoma where he has built up the electrical engineering department from small beginnings. In addition to the work at the university, he has done considerable outside work along engineering lines and has been in close connection with all of the electrical industries of the State.

John L. Fay, who has been superintendent of electrical distribution for the Union Electric Light & Power Company at St. Louis, Mo., has been appointed sales manager of the Paducah Pole & Timber Company, Paducah, Ky. Mr. Fay was formerly president of the St. Louis company's N. E. L. A. Section, and was actively engaged in other employees' activities, serving as director and chairman of the executive committee of the employees' mutual benefit association, as director of the employees' savings and loan association and as chairman of the central safety committee. Mr. Fay is also a member of the Engineers Club of St. Louis, the A. I. E. E. and the St. Louis Jovian League, and was recently appointed a member of the 1916-1917 committee on overhead lines and inductive interference of the National Electric Light Association.

Frank W. Frueauff, vice-president of the Cities Service Company and other Doherty organizations, and president of the Denver Gas & Electric Light Company, the twenty-fifth anniversary of whose entrance into the electrical field was marked by the receipt on Sept. 15 of many congratulatory telegrams from men of the electrical industry throughout the country, was born at Columbia, Pa., on March 29, 1874, and

F. W. FRUEAUFF

moved to Colorado in 1881. Finishing his high-school course in 1891 he entered the employ of the old Denver Consolidated Electric Company, with which he remained until its consolidation with the gas company in 1899. For the next eight years he served as secretary of the Denver Gas & Electric Company, and from 1907 until 1913 as vice-president and general manager of the company, becoming president in the year last mentioned. For a number of years Mr. Frueauff has been a partner in the firm of Henry L. Doherty & Company, and an official in the various Doherty public utility enterprises. He is a past-president of the National Electric Light Association, the National Commercial Gas Association, and the Colorado Light, Power & Railway Association, and is a member of many technical associations and clubs.

Obituary

Mathias Pfatischer, consulting engineer of the Electro-Dynamic Company, Bayonne, N. J., died at Roselle, N. J., on Sept. 10, after a connection with the company extending over twenty-seven years. Mr. Pfatischer was an electrical engineer and inventor, and devised the electric steering gear, with which several Russian battleships and one or two of the latest United States cruisers are equipped. He designed and engineered the electrical equipment on the first two large steamships built in the United States, the St. Louis and St. Paul, including such novel electrical features as the ship's telegraph, the propeller-shaft revolution indicators, the rudder indicator, etc. Mr. Pfatischer took a part in the early development of the single-phase alternating-current motor. In 1904 in the field of direct-current motors he invented the interpole variable-speed motor, and in 1908 was awarded the John Scott Medal by the Franklin Institute of Philadelphia for this invention. Mr. Pfatischer was a member of the American Institute of Electrical Engineers, the Electric Power Club, the Technical Society of New York, the Franklin Institute, and the Elektrotechnische Verein of Berlin.

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Steam Receiver Separators

In the accompanying illustrations are shown two types of receiver separators recently developed by the Elliott Company, 6908 Susquehanna Street, Pittsburgh, Pa. The function of a steam line, the manufacturer points out, is to convey from the boiler the steam required by the prime mover, and in all its parts it must be of ample strength to withstand the full pressure of the steam, with a good factor of safety. In addition, it must be of strong construction to resist all strains from the expansion and contraction stresses set up in the material due to temperature changes. To insure this, the pipe must be continuous throughout its length, and all weak points, where expansion or contraction stresses might be localized, must be eliminated. The Welderon receiver separator, it is claimed, has been constructed to fulfill such conditions.

These separators are built in three types—the horizontal, the vertical and the angle. In the vertical type shown in section in Fig. 1, the steam enters at the top and passes into the receiver chamber through the inlet port on the left. The inertia of the entrainment, due to its greater density, carries it to the bottom of the receiver out of the path of the steam. The steam circulates around the receiver and passes into the steam header again through the large outlet port shown on the left. The long baffle plates, extending at an angle from each side of the continuous pipe, prevent any particles of moisture from being carried from inlet to outlet ports, or from creeping along the pipe. The separator consists essentially of a part of the main steam header provided with a diaphragm and with inlet and outlet ports, and surrounded with a steel plate body or receiver. By this construction, it is claimed, there is no reduction in the strength of the main steam header, which is carried without break from boiler to prime mover, then eliminating any localization of expansion or contraction stresses, or any shock load due to vibration. Inside the receiver body the continuous pipe is divided into two distinct portions by a steam-tight diaphragm, which forces the steam with its entrained moisture from the steam header into the separator body through the inlet port, the area of which is only slightly in excess of the pipe area, thus causing the steam and water to enter the receiver at a very high velocity.

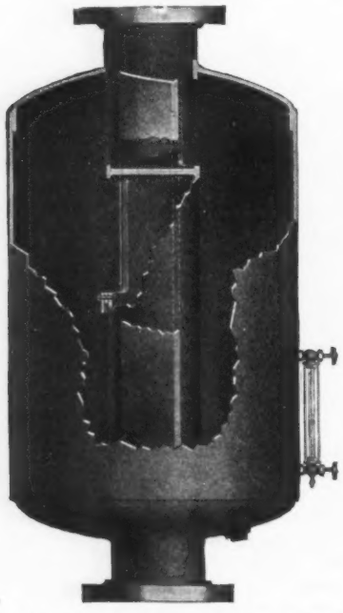


FIG. 1—SECTIONAL VIEW OF VERTICAL TYPE OF SEPARATOR

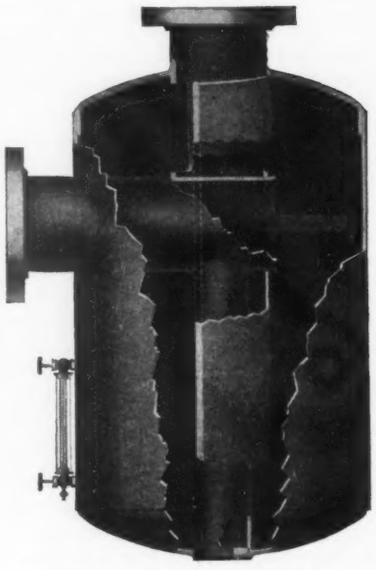


FIG. 2—ANGLE TYPE OF SEPARATOR

In the horizontal type of separator the steam enters and passes down into the receiver through the inlet port. The entrainment, due to its high velocity and its greater density, is carried to the bottom of the receiver and the steam that passes into the header again must circulate around in the receiver and rise to the outlet port in the top of the continuous pipe. Baffle plates similar to these in the vertical separator are provided to keep any moisture from reaching the outlet port.

The angle type of separator shown in section in Fig. 2 can be adapted for steam inlet at either top or side. The vertical pipe is fitted and welded to the horizontal pipe, and the joint is reinforced by a strong support extending to the bottom of the receiver, as well as by braces to each side. As in Fig. 1, a long baffle plate, extending on each side, is attached to the vertical branch of the pipe and prevents particles of moisture from being carried direct to the outlet port, as already described for the vertical design.

Inclosed Electric Hoist with Anti-Friction Bearings

The accompanying diagram shows construction features of an inclosed electric hoist equipped with Hyatt flexible roller bearings, which is made by the Economy Engineering Company of Willoughby, Ohio, for use in foundries and outdoor installations. The hoist frame is a cylindrical casting and supports the drum, brakes and motor. Openings in the frame allow these parts to be easily reached after removing the cover plates. The drum is centrally placed in the frame, there being only a small opening to allow the rope to pass through. This drum is made of cast iron suitably machined and grooved to take the rope for a given lift without overlapping. It carries the drum gear and revolves around the armature of the motor, reducing the over-all size of the hoist and giving a high lift. A cast-iron partition separates the drum from the gearing and brake.

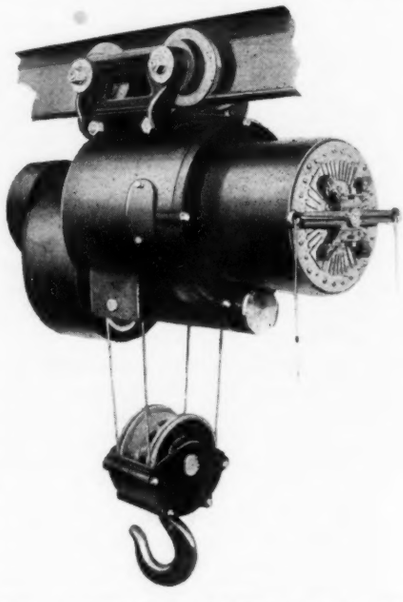


FIG. 1—INCLOSED ELECTRIC HOIST ASSEMBLED

There are twelve Hyatt bearings used in this hoist, six on the shafts to carry the gears, four in the trolleys and two

in the load block. These bearings serve to make the hoist trouble-proof and save energy and attention necessary in the operation of the hoist, it is pointed out. Furthermore, the manufacturer calls attention to the fact that the

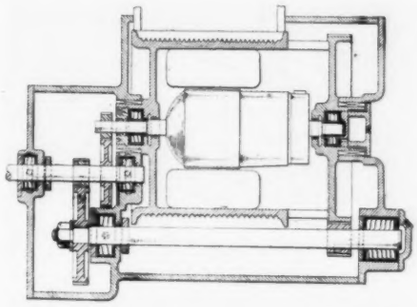


FIG. 2—DETAILS SHOWING BEARINGS OF ELECTRIC HOIST

gears all run in grease, so that the amount of lubricant needed, including that for the roller bearings, is small. Standard direct or alternating-current motors adapted for hoist service are used. An automatic limit switch cuts off the hoisting motor when the block reaches the limit of its travel. An electric brake operated by a solenoid holds the block with its load in any position when the current is off. The bearings of this hoist are furnished by the Hyatt Roller Bearing Company of Newark, N. J.

A New Spark Plug

The spark plug shown in the accompanying illustration is a new product of the Hartford (Conn.) Machine Screw Company. The feature of this plug, the manufacturer points out, lies in its construction and ability to stand extreme heat and cold. It consists of only three component parts

THREE-PART SPARK PLUG

—the two-piece steel shell and the Calorite insulator known as "Calorite." Two copper-covered asbestos gaskets form the cushion for the gas-tight joint between the insulator and the shell.

Motor Generator Set for Motion Picture Projection

A motor generator set, called the "Transverter," which will furnish a direct current of steady value to arc lamps for projection purposes, has been developed by the Hertner Electric & Mfg. Company of Cleveland, Ohio. The machine is of the vertical type, with rotating parts mounted on ball bearings, the construction being similar to that used in vehicle motors. The alternating-current motor is below the rotor, being of the conventional squirrel-cage type. The stator is wound for single, two or three-phase energy at ordinary commercial voltages and frequencies. A bipolar, shunt-wound generator is employed to permit large armature reaction at overloads. Interpoles are provided to improve com-

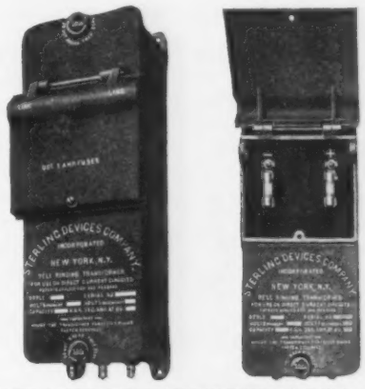
MOTOR GENERATOR SET ASSEMBLED

mutation, the design being such that over a wide range of voltage the machine will deliver practically a constant current on any setting of the field regulator.

Two types of machines are made. One type is intended to operate only one arc at a time. To connect a second projector it is bridged across the one already in operation which is then cut out of circuit. The voltage characteristics are such that over a range of fifty to seventy volts at the arc the ampere variation is small. No resistance is used in connection with the machine and the resulting efficiency is high. The second type of machine is intended to operate two arcs at the same time, thus permitting a change from one projection machine to another without any perceptible flickering. In these machines the two arcs are connected in series, the one not being used being short-circuited. Over a range of 50 to 120 volts the ampere variation is small. These equipments are furnished in 35, 50 and 75-amp. capacities suitable for one or two arcs.

Bell-Ringing Transformer for Direct-Current Circuits

A bell-ringing transformer for direct current, shown herewith, is made by the Sterling Devices Company, Inc.,

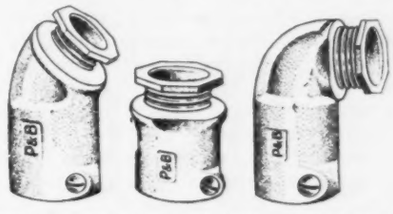


FUSE COVER OF TRANSFORMER CLOSED AND OPEN, SHOWING FUSES AND PRIMARY TERMINALS

of 601 West Twenty-sixth Street, New York City. Its construction is such that when connected to a 110-volt direct current lighting circuit a vibrating mechanism causes a small current to flow alternately, and in reversed direction through two primary coils of a static transformer. This creates an alternating current of low frequency in the secondary winding which is well adapted to operate bells, annunciators and kindred devices. Where this transformer is used, it is pointed out, the breaking contacts in the bells, which are a frequent source of trouble, may be eliminated, since the frequency of the current alternations will produce the required vibrating effect with ordinary vibrating bells and buzzers with breaking contacts. The conduit for the primary wires may be brought direct to the case, knockouts being provided on both sides.

Box Connectors

Three types of box connectors for use with flexible steel conduit and armored cable conductors are shown in the accompanying illustrations. These connectors are handled by the James E. Gleason Company, 106 South Clinton Street, Chicago, Ill., for the P. & B. Manufacturing Company of Mil-



THREE TYPES OF GALVANIZED MALLEABLE IRON BOX CONNECTORS

waukee, Wis. These connectors are made of malleable iron thoroughly galvanized in sizes for ⅜-in. to 2-in. conduit in the straight type and for ⅜ in. and 0.5-in. conduit in the 45 and 90 deg. styles. A feature of these connectors, it

is claimed, is a construction such that secure attachment is obtained by wedging the armor of the cable, instead of gripping, at the same time not injuring the conductor or armor.

Shade Holder Push Sockets

A shade holder specially designed for use with Cutler-Hammer push sockets is being marketed by the Plume & Atwood Manufacturing Company of Waterbury, Conn. The holder will also accommodate ordinary shades and

TWO-PART SHADE HOLDER FOR PUSH SOCKETS

glassware. Unlike the ordinary single-shade holder, the new holder comes in two parts, making installation very simple. A clamp collar is slipped over the fixture arm, the socket screwed in place and the body of the holder placed over the socket and secured by screwing the clamp collar to the threaded top of the holder. When the holder is locked in position the clamp collar rests on the cap of the socket, making a very secure fastening which improves the appearance of the completed fixture. In addition to the plain design shown in the accompanying illustration the manufacturers are also supplying the shade holders in reed and ribbon, and laurel and reed designs. Finishes of these holders are supplied to match the sockets.

Carbon Ground Cone

The essential features of a grounding device which is made by Hickey & Schneider of New York City and known as the Burn-Boston Carbon Cone, are shown in the accompanying illustration. This ground cone consists of a solid carbon electrode which is non-porous (1.5 in. in diameter by 23 in. long) surrounded by a carbonaceous mix which is porous and moisture-absorbing. This carbonaceous mix is closely compacted around the solid carbon electrode with the result that a low resistance conductor of 0.05 ohm is secured. The device is made in the shape of a long upright cone, so that the tamped earth will be closely in contact throughout its entire length. A copper lug connection is at the top of the solid carbon electrode, which is sealed in with a waterproof compound, leaving a tinned copper lug exposed ready for connection to a No. 4 line wire. This wire should preferably be rubber insulated and stranded. The manufacturers point out that in this device there is no metal in contact with carbon and moist earth, nor any metal in contact with moist earth alone, so that corrosion and disintegration of the grounding cone is impossible.

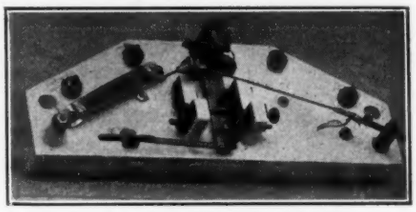
Before installing the cone it is soaked in a barrel of water for a few hours until air bubbles cease rising. Then a No. 4 stranded rubber-covered ground wire is soldered to the copper lug of the ground cone, the exposed joint and metal well taped with rubber and friction tape, and this covering painted with good insulating paint. The hole for receiving the cone may be dug with a post auger or hole digger, but should be at least 6 in. in diameter and should extend into moist earth. The ground cone may be installed in the same hole as the pole if desired, however. After the cone has been installed the earth should be thrown back into the hole and tamped against the ground cone. Wood

A NON-METALLIC AND NON-INDUCTIVE GROUND CONE

molding, fiber conduit or non-inductive material may be used to insulate the wire running from the cone to overhead equipment.

A Two-Way Thermo Flasher

A flasher designed to operate two circuits alternately, opening one circuit at the time it closes the other, is shown in the accompanying illustration. This device is to be known as the Tuway, Kelley & Kelley Thermo-Wynk flasher, and has just been introduced to the trade by the Betts & Betts Corporation, 511 West Forty-second Street, New York City. The action is positive, the manufacturer points out, since it is impossible for the switch blade to leave one contact without going to the other; that is, it cannot remain in the center and become inoperative. The switch blade is a piece of spring steel, pivoted on each end and bowed slightly, so that when the arm on which it is fastened moves in one direction, the blade is forced to bend back in the opposite direction and touch the other contact. The contacts are adjustable. The small strip in the upper left-hand corner of the illustration is a small condenser to reduce the arc on the contact points. The long coil of resistance wire is wound on a piece of steel wire, insulated with asbestos. This flasher, it is pointed out, will be useful for flashing colored sets of lamps alternatively, for switch-

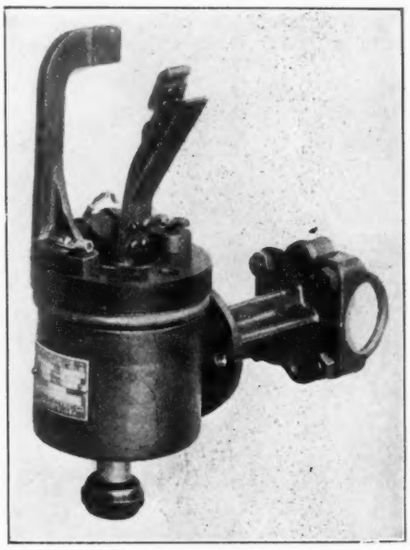


FLASHER THAT OPERATES TWO CIRCUITS ALTERNATELY

ing two portions of a sign, for illusions where the face lights up first, then the back of the sign, and for other similar effects.

Solenoid Control Relay

Solenoids for operating large carbon-break or oil circuit-breakers frequently require comparatively large currents in the closing solenoid. In such cases the contacts of the solenoid control switch which controls the operation of the solenoid are not suited to operate the closing solenoid, and it is necessary also to use a control relay with its operating coil excited by the closing contacts of the control switch and the relay contacts in series with the closing solenoid. A recently developed control relay is in use for this purpose. The relay consists essentially of a solenoid, plunger and contacts. There is a metallic connection, consisting of a small flexible lead, between the movable contact arm and its support. The contacts are kept clean by a wiping motion each



INSTANTANEOUS DIRECT-CURRENT SOLENOID CONTROL RELAY

time the relay is operated. The relay can be closed by hand by an insulated button on the lower end of the relay plunger. This relay is being made by the General Electric Company, Schenectady, N. Y.

NEWS OF THE INDUSTRY

A Review of Activities in the Electrical Manufacturing, Selling and Central-Station Fields

Montana Power Company Installs Wireless

The Montana Power Company recently completed the installation of a wireless station at its Rainbow plant near Great Falls as an auxiliary means of communication when the telephone line which follows the main power line is down or out of order. It is expected that the wireless will prove doubly valuable in case of storms, sleet, etc., when the telephone lines are apt to be out of commission, and will, in addition, save the company a considerable sum of money usually spent for long distance tolls when its private lines are down.

Milwaukee Enters Into Indeterminate Street Lighting Contract for City Parks

The City of Milwaukee through its Park Board has entered into a contract, under the indeterminate form, with the Milwaukee Electric Railway & Light Company to light Lake and South Shore parks. The parks have heretofore been partially lighted by gasoline lamps. The contract provides for a readjustment of price per lamp year in accordance with the cost of service annually and gives the municipality the right to terminate the contract at any time after two years, upon payment of the unamortized investment in special street lighting equipment. Similar plans are now being made for the lighting of other city parks.

This contract comprises the fifth indeterminate street lighting contract entered into by the Milwaukee Electric Railway & Light Company and its associated companies; the cities of Racine, Whitewater, Wauwatosa and the village of West Milwaukee having already entered into indeterminate street lighting contracts.

The rate per lamp per annum, according to which service is delivered during the first year, and the type and number of lamps supplied under these various contracts, are as follows:

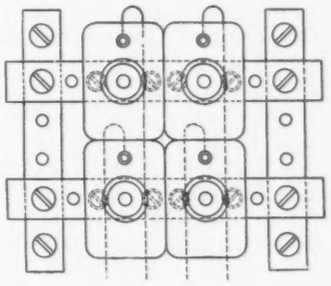
Location	No. Lamps	Type	Source Supply	Initial Rate per Lamp Year
Lake Park, Milwaukee	192	250 cp. Series Mazda	Underground	$35.94
South Shore Park, Milwaukee	28	250 cp. Series Mazda	Underground	35.94
Racine	345	4 amp. Magnetite	Overhead	53.52
	10	4 amp. Magnetite	Underground	78.70
	278	80 watt Series Mazda	Underground	20.16
	12	80 watt Series Mazda	Overhead	28.06
Whitewater	40	600 cp. Series Mazda	Overhead	48.74
	88	100 cp. Series Mazda	Overhead	22.04
Wauwatosa	220	60 cp. Series Mazda	Overhead	18.45
	8	250 cp. Series Mazda	Overhead	26.89
West Milwaukee	28	600 cp. Series Mazda	Overhead	42.34
	0	1000 cp. Series Mazda		54.15

Negotiations with respect to other contracts are pending in other cities in the Milwaukee district.

The indeterminate form of contract was first described in a paper by S. B. Way, read before the Milwaukee Electrical League on Feb. 21, 1914, and abstracted in the ELECTRICAL WORLD of Feb. 28, 1914. The details of this type of contract were described in a paper by G. W. Van Derzee before the Wisconsin Electrical Association. (ELECTRICAL WORLD, April 1, 1916.)

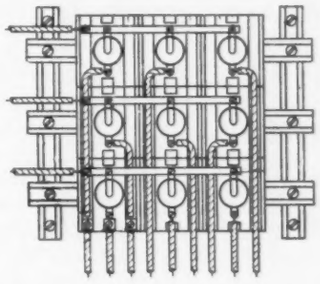
Novel Panelboard Construction

The Siemens-Schuckert Werke of Berlin, Germany, have been assigned patent No. 1,196,788, which discloses what appears to be a revolutionary form of panelboard construction, the invention of Wilhelm Klement of Spandau, Germany. The individual units are arranged on bars, and not on a fixed board, the bars being



SECTIONAL PANEL BOARD—TWO SECTIONS

connected together by crossbars. Usually panelboards are made by mounting individual units in the workshop on fixed boards and erecting these boards carrying the units at the place in question. The above invention, however, enables the individual parts of the



SECTIONAL PANEL BOARD—THREE SECTIONS

panelboards to be taken separately to the place of erection and readily mounted there. It also enables panelboards of any desired size to be assembled or at any time to be enlarged to any desired extent.

To Decide on Public Convenience Certificate Obligation

The question as to whether or not a certificate of public convenience and necessity imposes an obligation upon the public utility to which it is granted, whereby the utility must develop territory covered by the certificate, will shortly be determined upon by the Railroad Commission of California. The case is that of the Oro Electric Corporation, which recently made application for permission to transfer its public utility properties to the Pacific Gas & Electric Company. The hearing developed the fact that the Pacific Gas & Electric Company will take over the Oro properties under

terms whereby the former company will assume the bonded indebtedness of the latter, which is $1,830,000, and will buy from the Oro corporation $750,000 of the 6 per cent bonds of the American Gold Dredging Company. The Pacific Gas & Electric Company has already purchased the Oro's outstanding bonds for $1,495,000 and will furnish the dredging company with power. The purchase of the dredging bonds will enable the dredging company to pay off its debts.

Commissioner Thelen was desirous of ascertaining the attitude of the Pacific Gas & Electric Company toward certificates heretofore granted the Oro corporation, particularly covering territory west of the Sacramento River, which territory has never been developed for hydroelectric power distribution. About two years ago when the Oro corporation sought to obtain a certificate to operate in the city of Stockton under a franchise granted by the city, the commission enunciated for the first time the important principle that no public utility adequately serving a territory shall be disturbed by a competitor. The Western States Company was then serving Stockton. It is stated that the present transfer will not change the principle then declared.

Of the property to be transferred, it is said that twice as much of it is operative as non-operative and that the object of the transfer is to rid the Oro corporation of its public utility property, and that the property left will be the American Gold Dredging Company, which is non-utility. The reason given for the transfer is the inability of the Oro corporation to finance the business, which, it was stated, required the raising of $8,000,000 or $10,000,000 properly to carry on the work at this time. It is estimated that the corporation owns undeveloped hydroelectric power totaling about 130,000 hp.

Public Service Commission News

Wisconsin Commission

The Railroad Commission held in regard to the rates and service of the Poynette Electric Company that an electric utility operating only at night is entitled to compensation for operating its plant after the customary time of shutting down at night, for the accommodation of persons conducting dances, etc. Furthermore, an electric utility may require a power consumer to install a suitable device to limit the initial or starting current, where the starting of his machinery has caused difficulty in maintaining a uniform voltage on the lighting circuits.

Illinois Commission

In the case of Walter A. Daley vs. The People's Gas Light & Coke Company, the State Public Utilities Commission granted a refund to the petitioner, basing its decision on the meaning of the term "calendar year" contained in certain rules and regulations of the respondent.

"It appears from the testimony in this case that, in December, 1914, the complainant received from the respondent a gas bill in the amount of $11.16 for gas consumed principally during December, 1914. The discount period of this bill expired on Jan. 6, 1915. The complainant paid the net amount of the bill, $9.92, on Jan. 14, 1915, by a money order, which was accepted by the respondent and treated as an automatic request for the discount. In August, 1915, the complainant received from respondent another gas bill in the amount of $13.86 for gas consumed between May 20, 1915, and July 19, 1915. The discount period of the latter bill expired on Aug. 9, 1915. The complainant attempted to pay this bill by a money order covering the net amount of the same, and claimed that the said money order was mailed on the night of Aug. 9, 1915. The envelope containing the money-order remittance apparently is postmarked Aug. 10, 1915, 1.30 a. m. Later, the complainant requested the discount under Rule 5 hereinbelow.

"On Dec. 14, 1914, among other dates, the respondent had in effect a rule, which in March, 1915, was changed in form but not in substance, reading as follows: 'The payment of the net amount of a gas bill by bank check will be regarded as within the discount period only when the envelope containing the check bears the postmark of a date not later than the last day of the discount period. When a check for the net amount is received in an envelope bearing the postmark of a day later than the last day of the discount period, the amount will be credited to the account of the consumer and the latter notified that the amount of the omitted discount will be added to the next month's bill.' At the said date, and ever since, the respondent also had in effect a regulation known as Rule 5 reading: 'A consumer failing to pay his bill within the discount period may, upon request, be allowed the discount upon a single month's bill once in each calendar year but not oftener.'

"Both of the aforesaid rules being in full force and effect at the time the December and the July bills became due and payable, the questions arise (1) what constitutes a 'calendar year' under the said Rule 5, and (2) shall the allowance of a single discount refer to a bill due within the specified calendar year? The term 'calendar year' has been defined to mean 'a year from Jan. 1 to Dec. 31 inclusive, and not a period of twelve months commencing at any fixed or designated month, and terminating with the date of the corresponding month in the next succeeding year.' Carrol vs. Wright (131 Georgia 728, 743.) The Standard Dictionary defines the term 'calendar year' as the 'period of time from midnight of Dec. 31 to the same hour twelve months thereafter.' As thus defined, each calendar year must be treated separately and distinctly from any other calendar year. Bills for gas and discounts of one year should not be confused with similar bills and discounts of another year. Inasmuch as complainant, under the evidence herein, has received no other discount during the year of 1915, his claim for a discount on the bill due on July 28, 1915, should be allowed."

The Saline Electric Company, a public utility engaged in business principally in Saline County, has recently appeared before the commission with a plan to form an extensive electric transmission and distribution system by the consolidation and merging of several isolated plants in divers municipalities of southern Illinois. The plan embraces the purchase of the isolated plants, usually at a figure somewhat in excess of the present value of the tangible property. Following the rule of the Decatur Telephone Consolidation Case, the commission has permitted the temporary capitalization of the purchase price of the isolated plants, provided the present net earnings, if capitalized, will justify the purchase price. The commission, however, requires that the excess in the purchase price over the present value of the properties shall be amortized out of future net income over a period of twenty years.

The State Public Utilities Commission has authorized the Economy Light & Power Company to increase its rates for electric service in Blandinsville. The utility, under its existing rate schedule, is not securing sufficient revenue to meet operating expenses and to provide for accruing depreciation and reasonable return upon the fair value of the property. The new rates, while not sufficient to meet fully all fixed and operating charges, are more compensatory than the former rates.

Steel Mill Power Requirements.—Power purchased by steel mills in the United States from central stations has increased 50 per cent in the last four years, according to a statement made before the recent annual convention of the Indiana Electric Light Association. To-day steel mills are purchasing central station energy at the rate of over 425,000,000 kw.-hr. annually.

Atchison Company Opens New Office.—The Atchison (Kan.) Railway, Light & Power Company has opened a new office at Fifth and Commercial Streets. In a bulletin which the company issued to the public at the time of the opening, it was pointed out that the untility is now in its twenty-second year of operation. J. W. Waggener is general superintendent of the company.

Influence of Frequency of Alternating or Infrequently Reversed Current on Electrolytic Corrosion.—The importance of the results given in Technologic Paper No. 72 by the Bureau of Standards lies in the fact that there are large areas in practically every city in which the polarity of the underground pipes reverses with periods ranging from a few seconds to an hour or more due to the shifting of railway loads. The investigation shows that the corrosion under such conditions is much less than has generally been supposed. This paper is now ready for distribution and those interested in the subject may obtain a copy free by addressing a request to the bureau.

Making Salaries Public.—At a recent commission hearing, in which the cost of service was being analyzed with great care, counsel for the city requested that the names of all employees of the company's engineering department with the salary received by each man, be read into the record or filed as a public exhibit. Representatives of the company immediately offered objection on the ground that the publication of names and compensations corresponding had never been the policy of the utility in question, and that such a course would be likely to impair discipline. As the city did not press for a ruling at the time, the issue was not forced, but the point raised was of much interest and its discussion occupied the hearing for about half an hour.

Mammoth Sign for Minneapolis.—A new electric sign is being erected in Minneapolis by the Washburn-Crosby Company. It will cover the eight buildings of the company's flour mills, will be 400 ft. in length and the lowest part will be 150 ft. from the ground. Construction is in three sections. The first section, which will measure 47 ft. x 60 ft., will bear the word "Eventually," and will be located on the top of the tallest mill. The "E" of this word is 17 ft. high, and the tail of the "Y" measures 47 ft. from tip to tip. Six hundred and twenty-five 25-watt lamps will be used to illuminate the one word. The other two sections of the sign will each measure 17 x 200 ft. Electric energy for the illumination will be furnished by the Minneapolis General Electric Company.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Wireless for the Southern Sierras Transmission System.—After some experiments with wireless equipment, the Southern Sierras Power Company of Riverside, Cal., has decided to install several wireless stations at the company's plants so that communication will be independent of telephone lines.

Electric Vehicle Shakespearean Pageant for St. Louis.—What is claimed to be the only pageant of electric floats depicting scenes from Shakespearean plays that the world has ever known is scheduled to take place in St. Louis, Mo., next Tuesday night. This will be the crowning feature of a series of notable events in St. Louis commemorative of the Shakespearean Tercentenary.

Electric Power in Southern California Cotton Mills.—Six new cotton gins are being constructed in Mexicali, which is just over the international line from Calexico, Cal., by the El Compania El Godonera de la Baja California, a Mexican concern owned partly by American capital. These gins will require about 600 hp., which will be supplied by the Southern Sierras Power Company. The cotton industry in Imperial Valley is rapidly increasing.

Milwaukee Residence Rates Reduced.—The Milwaukee (Wis.) Electric Railway & Light Company has reduced the primary charge of its three-step lighting rate from 11 cents to 10 cents gross per kilowatt-hour, or to 9.5 cents net. This change is in line with the company's policy of reducing its rate when a predetermined number of electric customers are connected to its lines. The company has reached a total of 40,000 customers, and will reduce the rates again when a total of 50,000 is reached.

London's Central Station Service.—London probably has a more complicated system of central station service than any other city in the world. The city is served from a number of different plants operating at different voltages and frequencies. The following table shows how heterogeneous is the present situation:

	Central Area	Greater London
Number of authorities	39	70
Number of generating stations*	41	70
Average size of stations, kw.	7,649	5,285
Average size of units, kw	787	632
Number of types of systems of generation	31	49
Number of frequencies	8	10
Number of voltages:		
Generation	20	32
Distribution	21	24

*In addition there are nine traction stations within the Greater London area, eight of which are within the Central area.

Edison Naval Rookies Return.—Men from the Middle West who took part in the navel training trip aboard the U. S. S. Louisiana are home again. Among these there were eight men who took the trip at the expense of the Commonwealth Edison Company.

Large New Power Plant at Pennsylvania Town.—The Philadelphia Electric Company will soon commence the erection of a large electric power station at South Chester, with a total generating capacity of about 120,000 kw. The plant will be constructed in the form of two units, the first to be ready for operation in September, 1917, and will be operated by the company's subsidiary, the Beacon Light Company, according to present plans.

Los Angeles to Apply for Rehearing of Condemnation Suit.—The Los Angeles Water Board has announced that the city will file with the State Railroad Commission an application for a rehearing of the Edison condemnation suit. The purpose of the rehearing would be to secure, if possible, a reduction in the figure set by the majority of the commission for severance damage. Meanwhile it is reported that the city will proceed with its work of paralleling the Edison lines. Details of the commission's ruling will be found in the ELECTRICAL WORLD for Sept. 16, page 556.

Gas-Filled Incandescents to Replace Gas Lamps.—The Buffalo, N. Y., City Council has approved a five-year agreement with the Buffalo General Electric Company for the installation of 2500 Mazda C gas-filled electric lamps and a two-year contract for other arc lamps. The new contracts, involving an expenditure of almost $225,000 a year, will go into effect on Oct. 1. The rates for the new nitrogen lamps will range from $17 to $55.75 a year, the price depending upon the candle-power and whether they are supplied from an overhead or underground system. There will be a reduction of about $2 a year on the arc lamps, whose use will be continued. It is estimated that under the new contracts the city will save at least $40,000 a year. Almost 2000 gas lamps will be replaced with electric lamps.

Norwegian Electrical Statistics.—Official figures give the number of generating plants in Norway on July 1, 1915, as 1515, a gain in two years of 205. These plants had a capacity of 649,127 kw., which was more than the generating capacity of the country two years previous by almost 200,000 kw. Other figures showing the growth in the Norwegian electrical industry during the two years are as follows: Power taken by motors in 1913, 159,091 kw., in 1915, 216,809 kw.; by electrochemical works in 1913, 199,690 kw., in 1915, 304,128 kw.; by other users in 1913, 16,841 kw.. in 1915, 29,603 kw.; number incandescent lamps installed in 1913, 1,303,302, in 1915, 1,965,440; number of arc lamps installed in 1913, 4774, in 1915, 3603; number of motors installed in 1913, 16,460, in 1915, 24,689. At present there are installed in Norway 0.8 incandescent lamp and in the neighborhood of 0.09 hp. of motors for every inhabitant.

New York Jovian Rejuvenation.—The fall rejuvenation of the New York Jovian League will be held on Oct. 13 at the Hotel McAlpin. Efforts are being made by the local committee to have many of the more prominent men in Jovianism present.

The Toronto Section of the A. I. E. E. began regular monthly meetings on Sept. 22 in the rooms of the Engineers' Club. H. M. Hobart, consulting engineer of the General Electric Company, Schenectady, N. Y., was the speaker and his subject was "Electric Machinery Specifications Based on Modern Standards."

Meeting of St. Joseph Jovians.—The Jovian meeting of Sept. 20 in St. Joseph, Mo., will be attended by a number of prominent outside members, including Statesman at Large Elkas and Thomas Bibber of St. Louis, Mo., Statesman Louis and Martin J. Wolf, who will give a talk on salesmanship. The program calls for blackboard talks and other educational features.

Dayton Jovian Activities.—The first monthly dinner of the fall and winter season was held by the Dayton Jovian League on Monday evening, City Manager Waite being the principal speaker and guest of honor. He entertained the Jovians with an interesting account of his experiences as a student soldier at Plattsburg. The League is preparing for one of its characteristic big rejuvenations on Oct. 2, which will assist largely in stirring up enthusiasm for the coming convention at Indianapolis.

Philadelphia Iron & Steel Engineers' First Meeting.—The first monthly meeting of the Philadelphia section of the Association of Iron & Steel Electrical Engineers of the 1916-1917 season will be held at the Continental Hotel on Oct. 7. The speakers will be George W. Richardson, who will present a paper on the "Mechanical and Electrical Control of the Heroult Electric Arc Furnace," and T. S. Quinn, treasurer of the Lebanon Steel Foundry, Lebanon, Pa., who will speak on "Electric Steel Making." The meeting will be preceded by an informal dinner. Arrangements have been made for special entertainment. Linn O. Morrow, Nineteenth and Hamilton Streets, is secretary.

Toronto Electrical Luncheon Club.—Beginning on Sept. 1 the Toronto Electrical Luncheon Club resumed its weekly sessions. The luncheons are held, as last year, in the Prince George Hotel and are followed by short addresses. The speakers for the month of September were as follows: F. A. Gaby, chief engineer Hydro-Electric Power Commission of Ontario, on "Hydro Transmission," Sept. 8; A. Monroe Grier, vice-president and secretary of the Canadian Niagara Power Company, on "Philosophy and National Character," Sept. 15; Frederic Nicholls, president and general manager of the Canadian General Electric Company, on "Pioneer Days in Power Development in Canada," Sept. 22; Wills MacLachlan, inspector of the Electrical Employers' Association, on "Accident Prevention and Resuscitation from Electrical Shock," Sept. 29.

Associations and Societies

A complete Directory of Electrical Associations is regularly printed in the first issue of each month on the next-to-last text page.

Dallas Electric Club and Jovian League.—W. E. Griffitts, manager Postal Telegraph & Cable Company, gave a practical demonstration of the company's "call box system" at the regular weekly meeting on Sept. 8. He showed the various parts of routine through which a telegram goes from the time it is received until the time it is delivered.

Electric Car Sociability Run Under Auspices of New York Section.—The fourth semi-annual New York City Sociability Run for owners of electric pleasure cars is scheduled for Wednesday afternoon, Oct. 4, under the auspices of the New York Electric Vehicle Association. It is anticipated that between seventy-five and 100 cars will participate.

Schenectady Section, A.I.E.E.—At the recently held annual election of the section the following officers were chosen for the term which commenced on Aug. 1, 1916: Chairman, C. E. Eveleth; vice-chairmen, L. A. Hawkins, K. A. Pauly, T. S. Eden; treasurer, T. A. Worcester; secretary, H. L. Andrews. Officers elected last year and whose terms continue through the coming year are: Vice-chairmen, S. H. Blake, H. P. Broderson, W. L. Upson. The following committees have been appointed: Meetings and paper committee—chairman, L. T. Robinson, Dr. W. R. Whitney, Prof. E. J. Berg, H. M. Hobart and L. Gibson; entertainment committee—chairman, A. D. Kline; education committee—chairman, E. B. Merriam; apparatus committee—chairman, J. P. Rockford, membership committee—chairman, W. C. Fick. The first meeting of the year will be held early in October.

Chicago Chapter, A. A. E.—The Chicago Chapter of the American Association of Engineers at its meeting on Sept. 1 listened to Alderman Charles E. Merriam speak upon "City Government in Chicago," particularly upon engineering subjects which came to his attention on the Council committees. A. H. Krom, chairman national membership committee, informed the members that the association had been growing at the rate of about 100 a month, but due to the personal campaigns of various members it was increased to more than 200 new members for the month of August. The national association will hold its second annual booster dinner in Chicago at the City Club on Oct. 6. C. Francis Harding, professor of electrical engineering, Purdue University, will give the principal address on "Marketing Engineering Ability." John Ericson, city engineer, will tell of his experiences in hiring engineers and of their qualifications.

The Radio Club of America.—A meeting of the club was held on Sept. 15 at Columbia University, New York City. Alfred H. Grebe presented a paper on "A Modern Experimental Radiotelegraph and Telephone Station."

Western Society of Engineers.—The Western Society of Engineers was addressed Sept. 25 by Clinton B. Stewart, consulting engineer, Madison, Wis. B. E. Grant, president, announced that the board of directors had elected D. W. Roper, second vice-president, to the first vice-presidency to fill the vacancy caused by the death of C. H. Cartlidge. H. J. Burt was elected to fill Mr. Roper's place. Prof. C. T. Johnston will speak on "The Engineer and Public Service" on Oct. 2.

Akron Jovians Hold Rejuvenation.—The Jovian Electrical League of Akron held a rejuvenation on Sept. 23. The organization will meet once every week at a noon luncheon to discuss every phase of current electrical topics until the beginning of summer. A series of lectures will be given by many out-of-town experts, one of which will be on factory illumination by a National Electric Light Association engineer. These lectures will be delivered in factories, as the league has not decided upon any special location for its clubrooms.

Lynn Institute Section After Membership List of 1000.—The membership committee of the Lynn section, American Institute of Electrical Engineers, held a meeting on Sept. 19 for the purpose of making arrangements for the coming season. It is proposed to increase the membership of the section this year and the mark which the committee has in mind is 1000. Last year the membership was 786. This year, with the prevailing business conditions, a big increase seems assured. The tentative program for the winter which has been prepared calls for eleven lectures by well-known authorities. In addition there will be several special meetings with local speakers and the annual dinner which will be held in Boston on Feb. 3. Sightseeing trips will also be made to big industrial plants.

Old Telegraphers Meet.—Three hundred old time telegraphers met on Tuesday at the Hotel Astor, New York, to exchange reminiscences and have a good time. They are organized as the Old Time Telegraphers and Historical Association, and their reunion was a feature of the thirty-fifth annual meeting of the United States Military Telegraph Corps. In the afternoon the telegraphers took a trip around New York on a sightseeing yacht. A reception and dance at the Hotel Astor was held at night. The following officers were elected for the coming year: President, W. H. Canniff, Cleveland, former president of the Nickel Plate road; vice-presidents, T. W. Hill of the Cleveland National Bank, F. W. Strong, superintendent of the Postal Telegraph and Cable Company, Cleveland, and B. J. Ross, manager of the Western Union Telegraph Company, Cleveland; secretary and treasurer, F. J. Scherrer, New York. Next year's meeting will be in Cleveland.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

IMPROVING DEMAND FOR UNDERGROUND CONDUIT

Prospects Bright for Next Year, Though Scarcity of Labor and Higher Wages Are Delaying Deliveries and Causing Higher Prices

After a number of lean years manufacturers of underground conduit are again busy. Some very large jobs, such as the New York City subways, have kept certain manufacturers very busy for some years, but on the whole the demand for conduit has of late years been steadily dropping off. Government statistics for the year 1914 show that over 4 per cent less conduit was turned out in that year than five years previous. This is for both interior and underground conduit; but it is well known that the volume of business in the former has been increasing for some time.

Manufacturers of stone and clay conduit who answered the inquiries of the ELECTRICAL WORLD reported good business and the outlook for the future bright. The only manufacturer, however, of creosoted wood conduit reporting stated business was below normal, giving as the reasons the higher price of lumber and increased oil costs particularly. Fiber conduit appears to be in excellent demand, with good prospects.

Labor and, in certain kinds of conduit, scarcity of raw material have acted to hold back deliveries. Higher prices have been commensurate with advancing wages of labor except where the cost of raw material enters considerably into the ultimate cost. Labor plays a most important part in the underground conduit market. Besides being the predominating manufacturing cost, it is the predominating installation cost. Higher labor cost, therefore, is undoubtedly accountable for the business not being greater than it is.

Credits and collections have been good. Manufacturers have been more careful of recent years in extending credit, and have consequently fewer poor accounts.

CONDENSER TRADE VERY ACTIVE

Prices Considerably Advanced Owing to Existing Situation in Metal Market

Business in steam condensers is far in excess of what would be considered normal. Some manufacturers place their present output in the neighborhood of 200 per cent of that of normal years. During the several years of depression immediately preceding the European war no large undertakings were entered into for material extensions of existing plants, power stations, etc., or for work on new installations of that class. Between a year and a year and a half ago there was a sudden resumption of activity in such installations, causing an exceedingly large demand for steam turbines and condensers, not only in large numbers but also in units of very large capacity. The demand continues and manufacturers are unanimous in their opinion that present signs show no diminution of the market in the near future.

Prices have advanced materially, and for several obvious reasons. It is well known that during the years of business at a low level the builders of such machinery were compelled, in order to maintain their organization, to take orders at most unsatisfactory prices. Indeed, much of the business was done at very little above the cost of production. The large demand now existing for such machinery, taxing to the utmost the capacity of all builders, has had the natural consequence of permitting machinery builders to derive a profit from their operations more commensurate with the market. Besides the cost of both labor and material have been notably augmented. As a single illustration, condenser tubes, which constitute a large proportion of the cost of a steam condenser, are dependent in price upon the selling price of copper, which has advanced since 1915 considerably more than 100 per cent. These tubes and tube plates are made of brass and have increased in price from around 18 cents to the neighborhood of 45 cents.

Deliveries are longer than normal. The amount of business in hand makes it necessary to quote extended deliveries on new business. It has not proved easy for the manufacturer to increase the forces of skilled labor which are required for such work in the same measure as the business requiring such labor has increased. Both credits and collections are good.

One thing that was noted in the canvass of the manufacturers of steam condensers was that in spite of the increased business a number of manufacturers who formerly were in this line have, for the present, discontinued the manufacture of condensers. These places were for the most part foundries. Foundries have for the last twelve months been so cluttered up with orders for regular work that they have been forced to discontinue many of their side lines.

HEATING APPLIANCES PRICES

Increased Metal Prices and Necessity of Meeting Schedule Affects Cost of Appliances

Manufacturers of electric heating appliances are one by one raising their prices. The latest manufacturer to enter the fold is the Simplex Electric Heating Company, which late this week announced advances on a number of articles, taking effect on Sept. 25. Previous to this the Hotpoint Electric Heating Company, and Landers, Frary & Clark announced increases in some of their lines. Many of the range manufacturers, too, it is understood, have had to ask more for their products. The general impression throughout the trade is that an advance can be expected on practically all of the principal heating appliances.

How much of this raise is owing to the price of metal and how much to the necessity of meeting the license schedule it could not be learned. It is known, however, that prices are being placed on some articles that will bring them above schedule. Inasmuch as the owners of the Marsh patent have been exceedingly liberal in the matter of royalties, it is more than likely that the condition of the metal market is the predominating influence in arriving at prices.

A LARGE DEMAND FOR CHRISTMAS TREE OUTFITS

Growth of the Safety-First Movement and the Withdrawal of Germany and Austria from the Market Boosts Domestic Business

Business in Christmas-tree lighting outfits this year is unprecedented. There seems to be every reason for belief that the small electric lamps for Christmas trees have come to stay and will gradually replace the dangerous grease-dripping candles. Education of the public to the safety-first movement is developing and expanding, and has naturally had a marked influence upon the trade for lighting outfits. Furthermore, Germany, Austria and Holland, which formerly supplied large quantities of these decorative min-

iature lamps for Christmas purposes, have, for reasons of war or other markets nearer at hand, been forced practically to abandon the American market. So great has been the demand that a number of manufacturers have already been sold out. Last year was one of the best years the trade ever had, and as a result there was very little stock carried, so that the demand on the manufacturer this year is greater than usual for that reason also.

The prices have advanced this year, due to the advanced cost of manufacturing material. Deliveries, it is understood, are somewhat uncertain, as most mills manufacturing wire are behind in their deliveries. Deliveries have already begun and there is every reason to believe that manufacturers will be able to make deliveries on their entire output.

Owing to the increased demand this year manufacturers are more careful in extending credit, and as a result it is anticipated that collections will be very good.

LARGE BOILER MARKET

Inability to Make Better Deliveries Keeps Business from Further Increasing

Although the boiler market is enormous, the incoming orders at the present time are few. There is but one reason, and that is deliveries. Boiler manufacturers are swamped with business and are turning out the maximum amount possible. Could the manufacturers make better deliveries it is believed that they could increase their present business by half. Deliveries that under normal conditions took six weeks now take six months or longer. Labor has been accountable for this situation to a certain extent. Strikes have tied up some shops for a long time. Raw materials have, however, played the greatest havoc with deliveries. Castings have been difficult to obtain, but of boiler tubing it has been almost impossible to get sufficient quantities. The larger tube concerns have been forced to sell tubing to old customers pro rata, based on past orders. The tube people are sold out for months to come and will promise no deliveries.

Boiler buying on a large scale began early last fall, reaching its height in the winter months. Most of it is for industrial use. It has been roughly estimated that between 25 and 30 per cent of the orders this year have been for central station service. Many of the boilers for industrial service will be used for isolated electrical plants, however, making the total to be employed for generating electricity much larger. Many of such installations are for steel and iron mills.

While there has been a tendency lately toward particularly large turbine units, no such tendency has been evident in the boiler field. The units were of the average size.

CONDITIONS IN SECOND-HAND MARKET

Heavy Demand Has Greatly Reduced Stock, and Little Equipment Is Now Available for Replenishment

Conditions in the second-hand electrical equipment market are without precedent. The very slow delivery on new equipment on the part of the manufacturers has naturally turned much attention to used equipment, with the result that the stocks of the used electrical machinery dealers has been greatly reduced. Coupled with this unusual demand is a pronounced absence of desire on the part of owners to sell old and used machines. Central station companies and others generally are holding onto their old equipment, very largely as a means of helping out while awaiting delivery on additional equipment. Electrical machinery is at such a premium that they apparently are reluctant to sell the idle machine for fear of an emergency use for it, while the market conditions for electrical equipment are such as would make it practically impossible to get immediate delivery from outside on any machine to help out.

The dealers have had an unusual demand for direct-current motors and equipment generally. Up to the end of last year the market for this type of machines had been falling off and they had begun to shut down on purchases, due to the accumulation of direct-current stock. This was a reflection of the very wide move toward adopting three-phase, alternating-current drive on new work and the tendency to displace direct-current installations with the alternating-current type. The conditions prevailing in the market of four and five months' delivery on alternating-current motors, however, have caused a general turning back to the direct-current motors in second-hand stocks, and as one prominent dealer says, "These conditions have set the industry back about ten years in the type of equipment being used."

Despite unusual activity to secure used equipment for the trade, the stocks have fallen off 50 per cent of what they were a year ago and prices have increased at least 50 per cent on the average; but so important is the service of immediate delivery that price is repeatedly indicated to be of little moment.

Considerable difficulty is being experienced by the dealers in listing and quoting on machines, as the sales are so rapid as to make it continually necessary to inform the customer the article was sold between the time of quoting and receipt of his order.

LARGE FLASHLAMP TRADE

Estimates Place the Battery Production for Flashlamps for the Year 1916 at 130,000,000

Trade in flashlamps has grown to a tremendous total, increasing this year to greater totals than ever before. Much of this has been for foreign consumption although there has been an extraordinary demand from the domestic markets. A considerable part of the export business was to supply the soldiers in the trenches in Europe with lamps, and also for distribution in the British Isles. The air-raid defence acts curtailed the electric lighting to such an extent that there has developed a flourishing demand in England for flashlamps.

The sale of flashlamps in this country has been large for more than one reason. It has now outgrown the novelty stage and has taken its place as a commodity. Almost every hardware shop, electrical dealer's store, drygoods store, drug store and many others handle and push flashlamps. The secret is undoubtedly a regular list price which is well lived up to and an enormous discount. The profit is in the neighborhood of 100 per cent. Also, the manufacturer now stands back of his goods and if a battery proves defective the customer gets from the dealer a new one without cost and the dealer in turn obtains one free from the manufacturer.

Raw materials are hard to obtain and for that reason production has been curtailed to some extent. The cases are for the most part made of brass with a nickel finish, and these materials being in the war order class are about the most difficult of the raw products to obtain. Fiber is also used to a considerable extent for cases and this. too, is 'way behind on delivery. Considering this condition in manufacturing materials and also considering the labor situation that has prevailed and volume of business, that has developed, deliveries are excellent.

With one or two exceptions, producers have not as yet raised their prices to the domestic consumer in spite of the heavy increase in cost of materials. It is their aim to try to keep prices down by increasing the volume of output. For the export trade, however, it is understood there have been advances in price. The 1916 output of batteries for flashlamps has been conservatively estimated at 130,000,000, of which it is estimated 100,000,000 will be taken by the domestic trade and 30,000,000 by the export trade. Since the majority of these batteries are for renewal purposes these figures give no indication of the number of flashlamps that will be turned out this year.

There is always a large demand for this class of goods at Christmas time. Should the demand this Christmas come up to expectations it is estimated that the supply of batteries will amount to not more than 75 per cent, and of cases to not more than 60 per cent of the demand. For that reason manufacturers urge the trade to place their orders early so as to be sure of a sufficient supply.

With the demand as great as it is collections and credits have become much better.

Manufacturing and Industrial

John R. Allen has resigned as Chicago manager of the E. H. Freeman Electric Company, and has taken an active interest in the James E. Gleason Company, 106 South Clinton Street, which will in the future act as Chicago representatives for the E. H. Freeman Electric Company as well as for the Trenton Porcelain Company and the P. & B. Manufacturing Company.

St. Louis Apartment House Has Electric Ranges.—The Menteer Realty Company of St. Louis, Mo., has installed thirty-six electric ranges in its new apartment house at the corner of West Pine and East Kings Highway. The electric ranges, which were made by the Globe Stove & Range Company, Kokomo, Ind., are of the B-4 type with three top units, elevated oven and top and bottom heating units in the oven.

190,000 Hp. of Steel Mill Equipment Sold in Eighteen Months.—Speaking before the recent convention of the Indiana Electric Light Association at Fort Wayne, W. H. Patterson of the Westinghouse Electric & Manufacturing Company commented on the company's huge sales of power equipment. Since Jan. 1, 1915, said he, the company has sold seventy-two units for main rolls of steel mills, aggregating 190,000 hp. Thirty of these units will be operated by central station power.

Wire and Brass Factories Large Buyers of Copper.—The volume of copper sales during the past ten days was in the neighborhood of 75,000,000 lb., according to estimates of producers figuring largely on the business done. Domestic demand was from brass and wire mills. The brass plants laid in their requirements against recent record-breaking tonnages of finished goods sold to the banking agents of foreign governments. Wire mills bought copper against a renewal of demand for their products from domestic users.

Permissible Portable Electric Mine Lamps.—In the issue of the ELECTRICAL WORLD for Sept. 9, recent approved equipment by the Bureau of Mines was reported, Approval No. 13 and Approval No. 16 in the government report confused the names of storage battery manufacturers. The government report quoted in these items, stated that the iron-clad Exide battery was manufactured by the Edison Storage Battery Company of Philadelphia, Pa. The name, of course, should have been Electric Storage Battery Company of Philadelphia, Pa., manufacturers of the iron-clad Exide battery as quoted in the government report.

The VanDorn Electric Tool Company of Cleveland, Ohio, announces the opening of its new factory, which will about double the output capacity of the company. Railroad connection is furnished by a spur from the Cleveland Belt Line Railroad, which extends along a loading platform at the rear of the plant. The VanDorn Company specializes on only one line of equipment—portable electric tools—the departments being so arranged that testing of materials, manufacture and inspection of parts and the assembling and testing of the finished tools will proceed with the minimum amount of lost motion.

NEW YORK METAL MARKET PRICES

	Sept. 19 Selling Prices Bid	Sept. 19 Selling Prices Asked	Sept. 26 Selling Prices Bid	Sept. 26 Selling Prices Asked
Copper	£ s d		£ s d	
London, standard spot	116 0 0		116 0 0	
Prime Lake	27.75	to 28.25†	28.00	to 28.50†
Electrolytic	28.37½	to 28.62½†	28.37½	to 28.62½†
Casting	26.00	to 26.25†	26.62½	to 26.75
Copper wire base	33.00†		33.00†	
Lead	7.00		7.00	
Nickel	50.00		50.00	
Sheet zinc, f.o.b. smelter	15.00†		15.00	
Spelter	9.55	to 9.80	9.05	to 9.30
Tin, straits	38.50		38.62½	
Aluminum, 98 to 99 per cent	60.00	to 62.00†	61.00	to 62.00†
OLD METALS				
Heavy copper and wire	22.00	to 22.50†	23.00	to 23.50†
Brass, heavy	12.75	to 13.00†	13.00	to 13.25†
Brass, light	9.10	to 10.50†	10.00	to 10.50†
Lead, heavy	5.65	to 5.87½†	5.87½	to 6.00†
Zinc, scrap	6.00	to 6.50†	6.25	to 6.75†

COPPER EXPORTS

Total tons to Sept. 26 21,851

†Nominal.

Corporate and Financial

Hoosac River Electric Light & Power Company, Schaghticoke, N. Y.—The Public Service Commission for the Second District of New York has authorized the merger of the Schnectady Power Company and the Hoosac River Electric Light & Power Company. The latter company has been practically owned by the former for some years. The merger is to be without expense except for necessary taxes.

Merchants' Heat & Light Company, Indianapolis, Ind.—In its annual report for the year ended June 30, 1916, filed with the Indiana Public Service Commission, the operating revenues of the company for the year were given as $1,093,563.76, while operating expenses amounted to $606,557.87 and taxes amounted to $100,063.63, making a total deduction from the operating revenues of $706,621.50. This left net operating revenues of $386,942.25, according to the report, and to this was added non-operating revenues amounting to $11,416.77. The gross income thus totalled $398,359.02. From this amount bond interest in the sum of $206,604.59 was paid and miscellaneous deductions amounted to $17,377.26, or a total deduction from the gross income of $223,981.85. The net income for the company, as shown by the report, was $174,377.17. During the preceding year the net income of the company was but $105,214.14. During the year for which the report was made the company deducted from the net income a dividend to stockholders of $66,000, and a surplus accumulated during the year was left amounting to $108,377.17. At the beginning of the year the company had a surplus of $115,588.62, the report showed, while the annual surplus for the preceding year was given as $55,714.14. The total surplus of the company at the close of the year for which the report is made was given as $223,654.94. The total number of kilowatt-hours sold during the last year was 32,900,133, an increase over the preceding year's total, which was 19,027,453. The total number of customers of the company also jumped during the year just passed. The electric consumers during the year for which the report is given were 12,089 in number, while for the year preceding the total of this class of consumers was but 9,899. Steam heat customers last year numbered 480, and the same number was supplied during the preceding year. Hot water heat customers during the last year numbered 525 and this number did not change from the preceding year. The total of all consumers during the year just passed was 13,094—as against a total of 10,904 for the preceding year.

Toronto (Canada) Hydro-Electric System.—The fifth annual report for the year ended Dec. 31, 1915, has been made to the city. The operations for the year yielded the following results:

Gross income	$1,620,188
Expenses	979,209
Net from operating	$640,979
Non-operating charges	13,773
Balance	$627,206
Interest, depreciation and sinking fund	624,068
Surplus	$3,138

In their report the commissioners stated: "Satisfactory progress was made during the year 1915. Notwithstanding the reduction in rates ranging on the average in the different classes of service from 13 per cent to 28 per cent, the gross income shows an increase over that of 1914 of 7.9 per cent. The increase in the commercial income for the year amounted to nearly 66.4 per cent of the total against 63.9 per cent in 1914, and 59.05 per cent in 1913. The support of the general public is therefore steadily and satisfactorily increasing, and the business arising from supplying its requirements represents each year an increasing proportion of the total output. This is obviously a markedly satisfactory feature of the operations, indicating as it does an increasing confidence on the part of the public at large. The municipal income represents the balance of the year's business, or about one-third of the whole."

The energy sold for the year amounted to more than 109,500,000 kw.-hr., being an increase of over 30 per cent. The total revenue from the sale of energy did not increase correspondingly, owing to the substantial rate reduction

made as from January, 1915. In spite of this reduction, however, the total revenue increased about $100,000. That received from the civic services was actually about $3000 less than for the previous year due also to the rate reduction, although the energy supplied for such services increased about 11 per cent. The average price obtained from private customers, excluding energy for resale, was 2.01 cents per kilowatt-hour, whereas the corresponding figure for the civic services is 1.04 cents. The average price obtained for the total output sold for the year shows a reduction of more than 17 per cent. The net gain in the number of customers for the year exceeded 7100, and in the customers' connected load the gain was more than 21,000 hp. The peak load for the year was over 40,000 hp., an increase of more than 38 per cent. The capital expenditure during the year was less than in 1914, every effort being made to reduce the same to the lowest possible limit consistent with obtaining such new business as was available. Power purchased from the Hydro-Electric Power Commission of Ontario during the year amounted to nearly $431,000, an increase over 1914 of more than $105,000, or over 30 per cent. The total sum expended on operating and maintenance for the year, excluding power purchased, was smaller than in 1914 in spite of the greatly increased output.

Waupaca (Wis.) Electric Light & Railway Company.—The controlling interest in this company, which has been owned by Irving P. Lord for the last twenty-five years, has been sold to E. A. Aspness of Montevideo, Minn., and Truman Hibbard of Minneapolis, Minn. The property was capitalized at $50,000 and had $38,400 worth of bonds outstanding. The consideration is said to have been $100,000. The population of Waupaca is approximately 3000 and it is said to be the smallest city in Wisconsin to enjoy electric street railway service other than that afforded by interurban railways. Besides the steam and water-power property which the company has been operating, the deal is said to include a number of undeveloped water-powers. Mr. Lord, the former owner, will retire from the central station business and engage in the practice of law.

New Utility and Industrial Companies

The Banning (Cal.) Gas & Lighting Company has been incorporated by C. D. Hamilton, C. S. Holcomb and others. The company is capitalized at $25,000.

The Isolated Light & Power Company of Spartanburg, S. C., has been chartered with a capital stock of $10,000 by W. D. Burnett and George E. Ladshaw.

The Blue River Power Company of Oklahoma City, Okla., has been incorporated with a capital stock of $15,000 by W. M. Lucas, W. H. Bingham and D. C. Teter, all of Tishomingo, Okla.

The Loomis Electric Company, Akron, Ohio, has been incorporated with a capital stock of $10,000. The incorporators are C. H. Loomis, F. F. Loomis, Jr., Edith Loomis and Lillian Loomis.

The A. C. Mannweiler Company of Fort Wayne, Ind., has been incorporated with a capital stock of $25,000 to deal in electrical supplies. The incorporators are: A. C. Mannweiler, P. W. Mannweiler and Ellsworth Hartman.

The Guarantee Electric & Fixture Company of West New York, N. J., has been incorporated with a capital stock of $3,000 to deal in fixtures, etc. The incorporators are: Julius Davis, Mayer Klausner and others of Jersey City, N. J.

The Jacksonville Electric & Ice Company of Jacksonville, Tex., has been chartered with a capital stock of $90,000. The incorporators are: John Brown, R. W. Baker of Palestine, Tex.; G. C. Sloan and A. E. Fitkin of New York, N. Y.

Kaufman & Baron of New York, N. Y., have filed articles of incorporation with a capital stock of $1,000 to do a general electrical contracting business. The incorporators are: Herman Kaufman, 122 East 113th Street; Max Shames and S. G. Diamond, all of New York, N. Y.

The Commercial Enclosed Fuse Company of New York, N. Y., has been chartered with a capital stock of $10,000 to manufacture electric fuses, etc. The incorporators are: F. J. Rooney, J. Block, Fourteenth Street and Park Avenue, Hoboken, N. J., and J. C. Jackson, 1476 Broadway, New York, N. Y.

The Potlatch Consolidated Electric Company of Kendrick, Idaho, has been incorporated with a capital stock of $50,000 by A. V. Dunkle, A. Wilmot and A. W. Dunkle. This company is now furnishing electricity in Kendrick under the management of A. V. Dunkle.

The Knobnester Electric Company of St. Louis, Mo., has been incorporated with a capital stock of $20,000 by R. W. Morrison, W. S. McCall and Harry C. Loehr. The company proposes to operate an electric-light plant and do a general electrical business.

Trade Publications

Spark Plugs. — The Hartford Machine Screw Company, Hartford, Conn., has published an illustrated booklet describing its new "Calorite" spark plugs.

Clay Products.—"The L-C Bulletin" is the title of a four-page leaflet prepared by the Laclede-Christy Clay Products Company, Manchester and Sulphur Avenues, St. Louis, Mo.

Lightning Protective Devices.—Bulletin A-16, recently prepared by the Shaw Insulator Company of Newark, N. J., contains information on its various devices for lightning protection.

Inclosed Quick Break Switch.—The Ellcon Company, 50 Church Street, New York City, has issued a leaflet illustrating and describing the Anderson-Ellcon inclosed quick-break switch.

Gear Shift.—The Cutler-Hammer Manufacturing Company of Milwaukee, Wis., has issued a leaflet—"Petey Dink Gets Peeved"—on its C-H magnetic gear shift. The leaflet is illustrated with a clever cartoon.

Bell-Ringing Transformers.—A four-page leaflet on Sterling bell-ringing transformers for direct-current circuits has been issued by the Sterling Devices Company, 601 West Twenty-sixth Street, New York City.

Electric Vehicles.—The Woods Motor Vehicle Company of Chicago, Ill., has issued a pamphlet on the Woods dual-power car which contains interviews with prominent engineers who have expressed opinions on the car.

Motor Trucks.—The Packard Motor Car Company of Detroit, Mich., features the Packard's part in the response to the government's need in its September issue of the *Packard Truck Digest*. The paper contains sixteen pages full of interesting photos and stories of the work on the border.

Flexible Shafting.—Bulletin No. 102 recently issued by the Stow Manufacturing Company of Binghamton, N. Y., describes Stow flexible shaft, the many types manufactured and the various uses to which this shafting can be utilized. The bulletin is made up of sixty pages. The company has also prepared Bulletin No. 101 descriptive of electric tools, and Bulletin No. 100, entitled "Electric Motors." These bulletins are well illustrated.

Motor-Driven Fans.—The B. F. Sturtevant Company of Boston, Mass., has just issued Catalog No. 240 on electric fans that shows extreme care in make-up. The material has been arranged in a manner most acceptable and valuable to the buyer of motor-driven fans. Considerable data are given covering pressures, volumes, sizes, etc., to guide in the selection of a small fan for any specific purpose without consulting other sources of information. The text consists of sixty pages, mostly tables, with several pages devoted to actual installations.

Pumping Engines. — The Allis-Chalmers Manufacturing Company, Milwaukee, Wis., has issued considerable information on horizontal cross-compound pumping engines in its new seventy-six page catalog, No. 1637. This publication has been given permanent value by including numerous tables for computing cylinder sizes, length of stroke and floor space, diameter of plungers and valve area, duty per 100 lb. of coal, and friction loss and velocity of water in pipes. The effect of speed change on duty is also discussed. More than 60 per cent of the pamphlet is devoted to illustrations of pump installations and letters from users of the equipment. Bulletin No. 1810, which gives information on all-steel jaw crushers, has also been issued. This bulletin is well illustrated with general and sectional views as well as actual installations.

New England

BONDSVILLE, MASS.—Work has begun on the erection of a new power plant for the Boston Duck Company.

CHARLTON, MASS.—The Newburyport Gas & Electric Company is planning to erect a transmission line across the Merrimac River to Ring's Island, where it will connect with the system of the Amesbury (Mass.) Electric Light Company. Two transformers will be installed in the power station on Fiberloid Wharf.

NORTH ADAMS, MASS.—The New England Power Company of Shelburne Falls is planning to erect a transmission line over the mountains from the power plants on Deerfield River to supply electricity (about 1500 hp.) to the Beaver Mills.

PITTSFIELD, MASS.—The Pittsfield Electric Company has petitioned the Massachusetts Gas and Electric Light Commissioners for permission to extend its transmission lines into the town of Lee.

SPRINGFIELD, MASS.—The Springfield Gas & Electric Company has recently closed a service contract with the Springfield Creamery Company to supply electricty to operate two 40-ton refrigeratng machines and 235 hp. in motors. Service will be supplied at 2300 volts, three phase, 60 cycles.

WOONSOCKET, R. I.—The Blackstone Valley Gas & Electric Company of Woonsocket is contemplating extending its transmission line to North Attleboro, Mass., to serve as an auxiliary source of supply to the Union Light & Power Company of Franklin, Mass.

NEW BRITAIN, CONN.—A joint petition by the Stanley Works of New Britain and the Farmington River Power Company of Farmington has been presented to the Public Utilities Commission asking for permission to extend the high-tension transmission lines from Farmington to New Britain.

Middle Atlantic

AMSTERDAM, N. Y.—The city has recently entered into a contract with the Edison Electric Light & Power Company to erect ornamental lamps on East Main, Market and Division Streets.

AUBURN, N. Y.—The City Council is considering three propositions submitted by the Empire Gas & Electric Company for lighting the outer district of the city for a period of five years.

BROOKLYN, N. Y.—The Standard Knitting Company of Brooklyn has engaged Haller & Krumbhaar, 68 William Street, New York, consulting engineers, to supervise the remodeling of its plant for electrical operation.

BUFFALO, N. Y.—The North Main Street Business Men's Association has sent a petition to the City Council asking that magnetite lamps be installed on Main Street, from North Street to the city line.

BUFFALO, N. Y.—The City Council has approved a five-year contract with the Buffalo General Electric Company for the installation of 250 Mazda type "C," nitrogen-filled electric lamps and a two-year contract for other arc lamps. About 2000 gas lamps will be replaced with electric lamps.

CHATEAUGAY, N. Y.—The Chasm Power Company contemplates extending its transmission lines into all nearby towns, including Burke, Bellmont, Ellenburgh and Clinton; also to develop additional power in what is known as the Brayton hollow mill site, a short distance below the present plant, where it is estimated that from 800 to 1000 hp. can be developed. The company is now erecting transmission lines along the Quaker Settlement road to the Canadian line, and from there lines will be extended through a section of the town and thence to North Burke and to Burke Village. From the latter place lines will be built to Bellmont Center and Brainardsville, and thence to Ellenburgh Center, Cherubusco and Frontier, and from the latter place connection will be made with the Earlville line, thus completing a circuit covering the entire territory contiguous to Chateaugay.

ELLENBURG N. Y.—Preparations are being made by Thomas Hobbs to install an electric-light plant in Ellenburg.

FRANKLIN SPRINGS, N. Y.—The Progressive Electric Company of Franklin Springs has applied to the Public Service Commission for permission to erect a transmission line in the town of Kirkland.

ITHACA, N. Y.—The Ithaca Gas & Electric Company has applied to the Public Service Commission for permission to purchase the stock of the Norwich (N. Y.) Gas & Electric Company.

KINGS PARK, N. Y.—Bids will be received by the State Hospital Commission, Albany, N. Y., until Oct. 5, for new refrigerating machine at Kings Park. Drawings and specifications may be consulted at the Kings Park State Hospital, Kings Park; at the New York office of the Department of Architecture, 1224 Woolworth Building. Copies may be obtained at the Department of Architecture, Capitol, Albany. Lewis F. Pilcher is state architect.

LE ROY, N. Y.—The Board of Water and Light Commissioners have recently entered into a contract with the Le Roy Hydraulic Electric Company for street-lighting service. Under the new contract several changes will be made, including the installation of new lamps on Main Street. Steel posts will be used.

LOCKPORT, N. Y.—Extensive improvements are contemplated by the Hydraulic Race Company of Lockport, involving an expenditure of about $50,000. The company utilizes surplus waters from the Erie Canal, under a lease granted by the State, and sells it to industrial firms for power purposes.

NEW LEBANON, N. Y.—The town of New Lebanon has granted the Albany Southern Railroad Company of Hudson a franchise to supply electricity here. This extension will carry the company's system to the Massachusetts line.

NIAGARA FALLS, N .Y.—The International Railway Company of Buffalo has been granted permission to lay electric conduits in Twenty-fourth Street, from Allen to Buffalo Avenue. The company is planning to build a substation at Twenty-fourth Street and Allen Avenue.

OSWEGO, N. Y.—A temporary injunction has been granted Charles Carroll, restraining the city from proceeding with the plans for the construction of a municipal electric-light plant and the issuance of $345,000 in bonds, as authorized at a special election held Aug. 17. The sale of the bonds has been deferred and the bids returned.

PHOENIX, N. Y.—More than half of the industrial section of the village of Phoenix has been destroyed by fire, including power plant and pumping station. The fire started in the power station.

RENSSELAER, N. Y.—Negotiations are under way between the City Council and the Albany Southern Railroad Company of Hudson for a new street-lighting contract, under the terms of which the city will have many additional lamps for about the same price it is now paying.

THIELLS, N. Y.—Bids will be received by Frank A. Vanderlip, president of board of managers of Letchworth Village, 7 Wall Street, New York, N. Y., until Oct. 9, for construction, heating, plumbing and electric work for cottages E, F, G & H; construction plumbing and drainage, electric work and refrigeration equipment for storehouse, bakery, refrigerating plant and cold storage building, and for underground piping at Letchworth Village, Thiells. Drawings and specifications may be consulted at Letchworth Village, Thiells; at the office of F. B. Kirkbride, secretary, 7 Wall Street, New York City, and at the New York office of the Department of Architecture, Room 1224 Woolworth Building, New York. Copies may be obtained at the Department of Architecture, Capitol, Albany. Lewis F. Pilcher is state architect.

ALDAN, PA.—Permission has been granted to the Delaware County Electric Company of Lansdowne to install and operate an electric-lighting system in Aldan.

BRISTOL, PA.—The construction of a new power plant at the manufacturing plant of Warner J. Steel is under consideration.

CLIFTON HEIGHTS, PA.—Bids are being received by the Caledonia Woolen Mills for the erection of a new power station. F. E. Hahn is architect.

EDDYSTONE, PA.—Plans are being considered by the Philadelphia Electric Company for the erection of a new substation in Eddystone.

HALIFAX, PA.—The Borough Council has granted the Millersburg (Pa.) Electric Light, Heat & Power Company a franchise to extend its lines to Halifax and supply electrical service here. The company has been awarded a street-lighting contract under which it will furnish 28 lamps of 80 and 100 cp., to replace the gasoline lamps now in use.

HARRISBURG, PA.—Charters have been approved by Governor Brumbaugh for the Bell Township, Winslow Township and McCalmont Township Light & Power Companies to operate in these districts in Jefferson County. The incorporators are: John P. Rawson, Willard C. Sharp and Oscar Wagner of Scranton, Pa.

HARRISBURG, PA.—Eleven electric light companies of Western Pennsylvania have been consolidated under the name of the Midvale Electric Light & Power Company. They are the Ohio Township, Potter Township, Raccoon Township, Ferry, Georgetown, Midland, Glasgow, Hanover, Hookstown, Independence and Industry Light Companies. The new company is capitalized at $65,000. The officers are: S. L. Tone, president; James D. Callery, vice-president; W. B. Carson, secretary; C. J. Braun, Jr., treasurer, and C. B. Mitchell, controller, all of Pittsburgh.

HARRISBURG, PA.—Sixteen charters for electric companies to operate in Central Pennsylvania have been approved by Governor Brumbaugh incorporated by P. T. Davis, A. J. Musser and M. S. Musser of Clearfield, to supply electricity from Bellefonte. Each company is capitalized at $5,000. The companies are to operate in districts for which they are named as follows: Harris Township, Haines Township, Gregg Township, Liberty Township, Houston, Lamar, Marion Township, Miles Township, Stormstown, Penn Township, Worth, Taylor Township, Walker Township, Center County, Beech Creek and Beech Creek Township and Porter Township, Clinton County. Charters have also been granted to the Eagle Electric Light Company to operate in Bald Eagle Township and to the Mill Hall and Flemington companies for these boroughs. The incorporators are: W. S. Harris, Rees Kintzing and H. S. Furst of Lock Haven.

JONESTOWN, PA.—Application has been made for a charter for the Jonestown Light, Heat & Power Company by H .G. Louser, H. B. Daugherty and Harry Hollis of Lebanon. The company proposes to supply electricity in Jonestown. Energy will be secured from the plant of the Edison Electric Illuminating Company in Lebanon.

PHILADELPHIA, PA.—Plans are being prepared by E. F. Durang & Sons, architects, for a new power house for the Sisters of Mercy Hospital, Cedar Avenue.

PHILADELPHIA, PA.—Plans have been filed for erection of power house and kitchen wing for the Misericordia Hospital at Fifty-third Street and Cedar Avenue.

PHILADELPHIA, PA.—Bids will be received by the Department of Public Works of Philadelphia until Oct. 3 for new pumping machinery, consisting of two units of 35,000,000 gal. and 25,000,000 gal. daily capacity, to be installed at Lardner's Point and Queen Lane stations, respectively.

PITTSBURGH, PA.—A permit has been granted to the Pressed Steel Car Company for the erection of a power house on Bison Street, to cost about $4,500.

PITTSBURGH, PA.—The McDonald & Burgettstown Street Railway Company, recently incorporated with a capital stock of $100,000, contemplates the construction of an electric railway (15 miles long) in Washington County.

RIDLEY PARK, PA.—Application has been made to the Public Service Commission by the borough of Ridley Park for permission to award a five-year street-lighting contract to the Beacon Light Company of Chester, Pa.

SHARON, PA.—Contract for construction of the new conduit of the Bell Telephone Company has been awarded to William McIntyre & Sons of Sharon. The cost is estimated at $200,000.

WAYMART, PA.—The Scranton Electric Company is contemplating extending its transmission line to Waymart to supply electrical service here.

BLACKWOOD, N. J.—Plans have been prepared for a new power plant for the Camden County Almshouse in Blackwood.

CEDAR GROVE, N. J.—The Public Electric Company of Newark has applied for permission to install a street-lighting system at Cedar Grove and vicinity.

HAMMONTON, N. J.—The Delaware & Atlantic Telephone & Telegraph Company has applied to the Council for permission to lay underground conduits through Hammonton.

JERSEY CITY, N. J.—The installation of an ornamental lighting system on lower Broadway is under consideration by the property owners.

NEWARK, N. J.—The Board of Freeholders is considering equipping the laundry plant at the Overbrook Hospital for electrical operation, at a cost of about $8,000.

NEWARK, N. J.—The Board of Works has authorized call for bids for erection of municipal garbage disposal station, 300 tons capacity, and electric-light and power plant to be operated in connection with it.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

PARKERSBURG, W. VA.—The Kanawha Traction & Electric Company of Parkersburg has applied to the Public Utilities Commission of the State of Ohio for authority to issue $2,000,000 in bonds, the proceeds to be used to discharge notes and for improvements to property.

STAUNTON, VA.—The Blue Ridge Light & Power Company has decided to make improvements and extensions to its street railway system, to add new cars and increase the car barn facilities. W. F. Moore & Company, engineers, Pittsburgh, Pa., have been engaged to supervise the construction.

WILLIAMSBURG, VA.—The City Council has granted E. H. Clowes and associates of Richmond a franchise to construct and operate an electric-light plant in Williamsburg. The Council also entered into a contract with the company for street lighting under which it will furnish 50 street lamps for a period of five years. Work will begin at once on construction of the plant.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval station supplies as follows: Puget Sound, Wash., Schedule 175—26 pneumatic trolley hoists. Washington, D. C., Schedule 184—50 boat clocks, 400 deck clocks, 200 stadimeters. Various, Schedule 193—404,000 lb. boiler compound. Brooklyn, N. Y., Schedule 178—600 oil-burning running lamps. Philadelphia, Pa., Schedule 181—miscellaneous seamless copper tubing. Mare Island, Cal., Schedule 192—Miscellaneous seamless steel tubing; Schedule 190—composition unions. Pensacola, Fla., Schedule 170—one electric spot welder; Schedule 168—one motor-generator set. Application for proposal blanks should designate the schedule desired by number.

WASHINGTON, D. C.—Foreign trade opportunities are announced by the Bureau of Commerce reports as follows: No. 22,394—An American consular officer in Switzerland writes that a firm in his district desires to be put in communication with American exporters of magnetic steel and dynamo sheet metal. No. 22,408—The commercial agent of the bureau in New York City reports a return visit to the United States of a Portuguese merchant who desires to purchase and pay cash for the following goods: Electric cables, seamless tubes for boilers, steel plates for shipbuilding, tin plates in sheets for cans, engine lathes, gap lathes, planers, shapers, milling and drilling machines, bolt and nut machinery, woodworking machinery, wood and metal saws, tools, compressed air and steam hammers, electric and gasoline motors, etc. No. 22,415—The bureau is in receipt of a communication from a business man in Java stating that he desires to communicate with American manufacturers and exporters of general electrical supplies and devices. Catalogs, price list and full information should be sent. No. 22,420—An American consular officer in Chile writes that a firm in his district wishes to communicate with American manufacturers and constructors of aerial tramways. It is proposed to install a steam-driven plant capable of handling from 50 to 200 tons of coal per day of 12 hours. It is to be a double tramway on towers, about 3 miles long. Correspondence should be in Spanish. No. 22,442—An American consular officer in Chile reports that a firm in his district wishes to communicate with American manufacturers and exporters of aerial tramways and supplies. No. 22,447—An American consular agent in Ecuador asks to be supplied with names and addresses of American manufacturers of wireless apparatus. No. 22,449—A firm in the United States writes to the bureau that a Cuban merchant who is now in the United States wishes to secure exclusive agencies for the sale of the following articles in Cuba: Magnets and motors, and electrical and automobile accessories. Further information may be obtained on application to the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., and its district offices.

North Central

ANN ARBOR, MICH.—The Detroit Edison Company has taken over the property of the Eastern Michigan Edison Company in Ann Arbor. The power station at Geddes is to be replaced with an entire new plant.

ANN ARBOR, MICH.—Orders have been placed for new equipment for the new power house of the University of Michigan, consisting of a 300-kva., 2300-volt turbo-generator with Westinghouse Le Blanc, jet type, condenser and other necessary auxiliary equipment. Lyman R. Cook is superintendent of building and grounds.

DETROIT, MICH.—Plans are nearly completed for the new freight terminal to be erected in Detroit by the Detroit United Railway Company, at a cost of about $1,000,000.

GRAND RAPIDS, MICH.—The National Brass Works is considering the erection of a power house, 45 ft. by 80 ft.

GRAND RAPIDS, MICH.—The ways and means committee will recommend to the Council the installation of 60 new street lamps.

MANISTEE, MICH.—Preparations are being made by the Consumers' Power Company of Jackson for the construction of a dam on the Manistee River, about 30 miles from here. Plans provide for a development of about 22,000 hp.

PONTIAC, MICH.—Application has been made to the City Commission by the Detroit Edison Company for permission to erect a substation in Pontiac, to cost about $75,000. The company also contemplates the construction of a power house at Bunce Creek to supply energy to the city railway and the rapid railway system.

TWO RIVERS, MICH.—The city of Two Rivers has notified the State Railroad Commission that it has decided to close down its generating plant and to purchase electricity from the Wisconsin Public Service Company of Green Bay. The company has been granted a certificate of convenience and necessity to enter the city.

YPSILANTI, MICH.—Bids will be received at the office of Sumner Damon, city clerk, Ypsilanti, Mich., until Oct. 18, for construction of hospital building. Separate bids will be received for heating, plumbing and electric wiring. Plans and specifications may be obtained at the office of E. R. Dunlap, architect, Detroit.

CINCINNATI, OHIO.—Plans are being considered for extensions of the present limits of the boulevard lighting system. William Kleine is city electrician.

LORAIN, OHIO—The construction of a new exchange building and the installation of complete new telephone system, to cost approximately $150,000 in Lorain has been authorized by the Black River Telephone Company.

MARTINS FERRY, OHIO—Improvements to the municipal electric-light plant are under consideration.

NEWCOMERSTOWN, OHIO—The Town Council has authorized plans prepared for a municipal electric-light plant.

RITTMAN, OHIO.—The city of Rittman, it is reported, will receive bids until Nov. 1 for erection of transmission line from power plant to pumping station.

UHRICHSVILLE, OHIO—The installation of a municipal electric-light plant is under consideration.

LEXINGTON, KY.—The Kentucky Utilities Company of Lexington purchased the electric plants at Morganfield and Uniontown, recently reported sold.

OXFORD, IND.—The proposal to make improvements to the municipal plant, at a cost of $10,000, or to purchaes energy from an outside company will be submitted to the voters at the November election.

ST. JOE, IND.—The Public Service Commission has authorized C. M. Lott, owner of the electric-lighting and transmission system in St. Joe and Spencerville, to sell his property to the Butler (Ind.) Utilities Company for $5,400. Electricity to operate the system was formerly purchased from the plant in Hicksville, Ohio.

SOUTH BEND, IND.—The St. Joseph Tuberculosis Hospital Association is considering the erection of a power plant at hospital.

SULLIVAN, IND.—The County Commissioners have granted the Sullivan (Ind.) County Electric Company permission to proceed with its plans for the erection of high-tension transmission lines across various railroad tracks in Sullivan County.

BERWYN, ILL.—Bids will be received by the City Council until Oct. 23 for the installation of a fire alarm system in North Berwyn. For details see proposal columns.

DE KALB, ILL.—The De Kalb-Sycamore Electric Company contemplates extensions to its power plant.

METROPOLIS, ILL.—The city of Metropolis has purchased a 312-kw. generating unit, consisting of a Chuse engine directly connected to a General Electric generator to take care of the increased load of the municipal electric plant. The city will erect a three-phase transmission line to the plant of the Wilson Stove & Manufacturing Company of Metropolis at once. The plant will also supply electricity to the American Bridge Company to drive the air compressors required in the construction of the $4,000,000 bridge now being built at Metropolis. P. M. Richards is superintendent.

WILMINGTON, ILL.—The City Council is considering the installation of a new street-lighting system.

EAU CLAIRE, WIS.—The Wisconsin Railroad Commission has granted the Wisconsin-Minnesota Light & Power Company permission to issue $312,000 in capital stock and $750,000 in bonds.

HORTONVILLE, WIS.—Steps, it is reported, have been taken to organize a company to take over the holdings of the Hortonville Light, Heat & Power Company and install an electric-light plant here.

MILWAUKEE, WIS.—New bids have been asked by Fred G. Simmons, commissioner of public works, on concrete post shafts and brackets for the municipal electric distribution system.

MILWAUKEE, WIS.—Plans are being prepared by A. C. Eschweiler, architect, Goldsmith Building, Milwaukee, for a telephone exchange 24 ft. by 22 ft., to be erected in East Milwaukee, for the Wisconsin Telephone Company.

MOSINEE, WIS.—The property of the Mosinee Electric Light & Power Company has been purchased by the Wisconsin Valley Electric Company of Wausau.

NEENAH, WIS.—The city officials are considering plans to install electric power in the municipal waterworks system, to replace steam power now in use.

NEW LONDON, WIS.—Application has been made to the City Council by F. H. Joslyn, representing an Oshkosh holding company, which owns the Ostrander and other Little Wolf River power sites, for a franchise to supply electrical energy in New London. The proposal is a tentative one, dependent on securing contracts in Shiocton, Blackcreek and Seymour.

OCONOMOWOC, WIS.—The City Council is considering asking for bids for furnishing electricity for street lighting.

CANBY, MINN.—Bids will be received until Oct. 18 by the board of education of Canby for construction of high school building. Separate bids to be submitted on heating and ventilating, electric wiring, science laboratory equipment, etc. Plans may be seen at the office of Ole Ostensoe, Canby, and at the office of G. L. Lockhart, architect, 285 Endicott Building, St. Paul, Minn.

HOLT, MINN.—H. J. Olsen of Warren, Minn., is reported to have secured the contract for the installation of an electric-light and power plant at Holt.

PRINCETON, MINN.—The installation of a fire alarm system in Princeton is under consideration.

VIRGINIA, MINN.—Work has begun on enlarging the local power plant of the Great Northern Power Company which will double the output of the station. New equipment will include one 3500-hp. turbine and two 500-hp. boilers. H. J. Underhill is local superintendent.

ALDEN, IOWA.—A franchise has been granted to the Iowa Falls (Iowa) Heat, Light & Power Company to extend its transmission lines to Alden.

CLARION, IOWA.—A petition is being circulated asking that a franchise be granted for the installation of an electric-light and power plant in Clarion.

FARMINGTON, IOWA—We are informed that the municipal electric-light plant was not destroyed by fire as reported in the issue of Sept. 16. A coal shed was burned and the ceiling of the engine room slightly damaged.

ROCKWELL CITY, IOWA—The property of the Calhoun County Public Service Company of Rockwell City is reported to have been purchased by the Federal Light & Power Company. A high-tension transmission line will be erected at once from Sac City to Rockwell City; transmission lines will also be built to Lake City and Lohrville, where the Federal company has recently secured franchises to supply electricity. Energy will be purchased from the Fort Dodge, Des Moines & Southern Railroad Company of Boone.

TORONTO, IOWA.—The Iowa Electric Company of Marengo has been granted a franchise to supply electricity in Toronto.

VALLEY JUNCTION, IOWA.—Bids will be received at the office of A. H. Minnes, president of board of education, Valley Junction, until Oct. 24, for construction of high school building for the Independent School District of Valley Junction. Separate bids to be submitted on electric wiring, heating and plumbing. Copies of plans and specifications may be obtained upon application to Proudfoot, Bird & Rawson, architects, 810 Hubbell Building, Des Moines.

LEES SUMMIT, MO.—Application has been filed with the Public Service Commission by L. K. Green & Sons for permission to purchase the property of the Lees Summit (Mo.) Light & Power Company, for $19,000.

PARIS, MO.—Bids will be received by the city of Paris until Oct. 6 for the installation of a filtration plant (to cost $12,500), including two electrically driven centrifugal pumps. W. B. Rollins & Company, Kansas City, Mo., are engineers. George C. Blakey is superintendent of the municipal water and light plant.

ROCKPORT, MO.—The town of Rockport has granted Charles L. Hamer and O. W. Clifton a 20-year franchise to construct and operate an electric plant here, under the terms of which they will take over the municipal lighting plant at $8,500. The city has also awarded Clifton & Hamer a 10-year contract for street lighting. A complete new plant and equipment will be erected. When completed a 24-hour service will be established.

GRANVILLE, N. D.—Preparations are being made by Messrs. Bacon and Burr for the installation of an electric-light plant in Granville.

HALLIDAY, N. D.—Arrangements are being made by J. F. Wenrick for the construction of an electric-light plant in Halliday. Machinery, it is understood, has been purchased.

LANKIN, N. D.—A franchise has been granted to M. S. Hyland of Fargo to construct and operate an electric-light plant in Lankin.

BEATRICE, NEB.—At an election to be held Oct. 17 the proposal to issue $25,000 in bonds for enlarging the municipal electric plant to supply electricity for commercial purposes will be submitted to the voters.

BELLWOOD, NEB.—Bids, it is reported, are being asked for by the town of Bellwood for the construction of an electric-light plant and pumping station.

NORFOLK, NEB.—The Nebraska Gas & Electric Company is planning to extend its transmission line from Tilden to Oakdale, a distance of about 10 miles.

AUGUSTA, KAN.—Bonds to the amount of $10,000 have been voted for extensions to the municipal electric-light plant.

KANSAS CITY, KAN.—The County Commissioners have granted the Standard Electric Light Company permission to lay conduits and erect poles and wires on all the roads in Wyandotte County.

McPHERSON, KAN. — Improvements contemplated to the municipal electric-light plant include a 300-kw. generating unit, water tube boilers, condenser, new well and pumps. Arthur Groesbeck is manager.

WICHITA, KAN.—The Kansas Gas & Electric Company of Wichita contemplates extensions and improvements to its system, involving an expenditure of about $300,000.

Southern States

BELHAVEN, N. C.—The proposal to issue $60,000 in bonds for construction of electric-light plant, water-works and sewer system will be submitted to the voters.

CAMDEN, S. C.—Bonds to the amount of $7,000 have been voted for improvements to the municipal electric-light plant.

CENTRAL, S. C.—Bonds to the amount of $10,000 have been voted for the installation of an electric-lighting system. Energy, it is understood, will be purchased from the Liberty (S. C.) Light & Power Company, and a transmission line erected from Central to power house at Hunter's Mill on Twelve-Mile River.

McCORMICK, S. C.—The Isolated Light & Power Company of Spartanburg has applied to the Town Council for a franchise to supply electricity in McCormick.

SPARTANBURG, S. C.—The Isolated Light & Power Company, recently incorporated with a capital stock of $10,000, proposes to construct a small power plant and erect a 7-mile transmission line. George E. Ladshaw is engineer.

ELLENTON, FLA.—Contracts have been awarded by the city of Ellenton for the installation of an electric-light plant.

LAKE BUTLER, FLA.—The Council is considering calling an election to submit to the voters the proposal to issue $10,000 in bonds for the installation of an electric-light plant.

ST. PETERSBURG, FLA.—The St. Petersburg Electric Light & Power Company is erecting a 22,000-volt transmission line to Clearwater, a distance of 20 miles, to supply electricity to operate the system there. The company is also installing a 1500-kw. steam turbine and jet condenser with auxiliaries in its local plant. F. R. Weller, Hibbs Building, Washington, D. C., is consulting engineer.

SPRINGFIELD, TENN.—The Council is contemplating improvements to the municipal electric-light plant and water works system.

BESSEMER, ALA.—The Alabama Power Company of Birmingham is contemplating the erection of an electric transmission line from Bessemer to Jasper.

LULA, MISS.—Preparations are being made by the Lula Light & Water Company for the installation of an electric-light plant. Bids have been asked for equipment. T. H. McKenzie is interested.

CANTON, OKLA.—The installation of an electric-light plant in Canton is under consideration. O. A. Hunt of Watonga is interested.

MUSKOGEE, OKLA.—The Muskogee Gas & Electric Company has entered into a contract with the city which provides for the installation of 417 nitrogen-filled street lamps by Nov. 1.

OLUSTEE, OKLA.—The City Council is considering the installaton of an electric-lighting system.

WAYNE, OKLA.—Plans are being considered by the City Council for the installation of a municipal electric-light plant.

WOODWARD, OKLA.—Bonds to the amount of $15,000 have been voted for extensions to the electric-light plant and waterworks system.

DALLAS, TEX.—The General Electric Company, through Charles W. Hobson of Dallas (it is reported), has obtained a lease on the Oak Cliff lines of the Northern Texas Traction Company. Extensions and improvements, it is understood, will be made to the property.

HOUSTON, TEX.—The City Council has contracted with the Houston Lighting & Power Company for furnishing energy to operate the sewage disposal plants.

SWEETWATER, TEX.—The West Texas Electric Company is planning to enlarge its electric plant in Sweetwater. The company has recently increased its capital stock from $300,000 to $500,000.

VERNON ,TEX.—We are informed that there is no municipal electric plant in Vernon at present. The city has purchased a small machine to operate the street-lighting system, but it is not yet installed. An item published in the issue of Sept. 9 stated that improvements were to be made to the municipal plant.

WICHITA FALLS, TEX.—The capital stock of the Wichita Falls Electric Company has been increased from $700,000 to $775,000. Improvements will be made its plant.

Pacific States

CONNELL, WASH.—The city of Connell has taken over the local electric-lighting and waterworks systems.

FIR, WASH.—The Puget Sound Traction, Light & Power Company of Bellingham is extending its transmission line to Fir.

ALBANY, ORE.—The City Council is considering submitting to the voters at the December election a proposal to issue bonds for the purchase of the local electric-light and power plant and waterworks system, owned by the Oregon Power Company.

BANDON, ORE.—Work will soon begin on the construction of a new lighthouse at the mouth of Coquille River. The light for signalling and other apparatus will be operated by electricity. The cost of the station is estimated at $6,000.

JORDAN VALLEY, ORE.—Investigations are being made by the Electric Investment Company of Boise, Idaho, with a view of extending its transmission line from De Lamar, Idaho, to Jordan Valley.

KLAMATH FALLS, ORE.—A power plant is contemplated under a proposal of the United States Reclamation Service, which calls for construction of a dam on Line River at Klamath Falls. It is proposed to lease the power privileges to private parties.

MARSHFIELD, ORE — The Oregon Power Company is planning to change the arc street-lighting system in Marshfield to the new reflector system.

PORTLAND, ORE.—According to reports an item of $15,000 is to be included in the 1917 budget for the installation of a lighting system in Mount Tabor Park. Poles have already been set. Philip Dater is city engineer.

SPRINGFIELD, ORE — The Oregon Power Company is contemplating extending its transmission lines into districts not now served with electricity.

THE DALLES, ORE.—The City Council has decided to enter into a 10-year contract with the Pacific Power & Light Company for lighting the entire city. The contract calls for 168 100-watt lamps to replace the 53 lamps now in use.

COLUSA, CAL.—The installation of a municipal electric-light plant in Colusa is under consideration.

FRESNO, CAL.—A resolution has been adopted by the City Trustees providing for the installation of an electrolier lighting system on South L Street.

NOVATO, CAL.—The city has decided to extend the electric-lighting system to the outside districts.

SAN FRANCISCO, CAL.—The Board of Public Works has awarded the contract for four 1000-kva. electric transformers, complete with auxiliaries, for the Lower Cherry River power development, in connection with the Hetchy Hetchy water supply, to the Westinghouse Electric & Manufacturing Company of Pittsburgh, Pa., at $7,700. All other bids received for the above work were rejected.

TULARE, CAL.—The trustees are considering plans for the installation of an electrolier lighting system in the business district. It is proposed to install about 60 lamps, to cost about $3,000 per year.

WOODLAND, CAL.—The Yolo Water & Power Company of Woodland is contemplating extensions and improvements to its system. W. G. DeCelle has been appointed president and general manager.

YOSEMITE, CAL.—Bids will be received at the office of the supervisor of Yosemite National Park, Yosemite, Cal., until Oct. 12 for furnishing and installing hydroelectric equipment for the park, consisting of water wheels, generators, transformers and switchboard. For details see proposal columns.

KELLOGG, IDAHO.—A franchise has been granted to the Washington Water Power Company of Spokane to erect a high-tension transmission line to the city limits and to install a distributing system.

COALVILLE, UTAH—At a special election held recently the proposal to sell the municipal electric-light plant was carried. The high-tension transmission line which is being erected by the Utah Power & Light Company of Salt Lake City will reach this city.

BAKER, MONT.—Improvements are contemplated to the plant of the Baker Light & Power Company, to cost about $6,000, and will include a new engine and generator. An addition will also be made to the power house.

GREAT FALLS, MONT.—The Montana Power Company has recently completed a wireless station at its Rainbow plant near Great Falls as an auxiliary means of communication to telephone lines. The company proposes to install a number of wireless stations at its various properties in this section.

MISSOULA, MONT.—The Missoula Light & Water Company is planning to install electric control over the valves at the waterworks reservoir.

GREELEY, COL.—The contract for the installation of the lighting fixtures in the new Weld County court house at Greeley has been awarded to the Albert Sechrist Manufacturing Company of Denver, at $11,000.

TRINIDAD, COL.—Extensions are being made to the plant of the Trinidad Electric Transmission, Railway & Gas Company, including the installation of a 5000-kw. turbine. Haller & Krumbhaar, 68 William Street, New York, N. Y., are consulting engineers.

DEMING, N. M.—The Deming Ice & Electric Company has erected a transmission line (2½ miles long) to the military camp and government hospital, established outside of the city. While the camp may be only temporary the hospital is a permanent structure, and will require service indefinitely.

Canada

BASSANO, ALTA.—A by-law to appropriate $7,000 for the purchase of the electric-light and power plant of the Alberta Electric Company will be submitted to the ratepayers.

DUNDAS, ONT.—The Ontario Hydro-Electric Commission contemplates duplicating the equipment at the local distributing station.

ESSEX, ONT. — The Hydro-Electric Power Commission of Ontario is reported to have taken options on the plants of the Essex County Light & Power Company.

RENFREW, ONT.—At an election held recently the ratepayers defeated a by-law providing for a power development by the Ontario Hydro-Electric Commission on the Bonnechere River. While it is agreed that more power is needed, the ratepayers felt that the proposal submitted by M. J. O'Brien to develop 5000 hp. on the Madawaska River at $15 per horsepower is better for the town than having the commission transmit 1500 hp. from Bonnechere at $13 per horsepower.

Miscellaneous

HONOLULU, HAWAII.—Extensive improvements are being made to the Government electric-light plant, including the installation of one 650-kw., three-phase, 2300-volt, revolving field generator and a 20-kw. exciter with general service board and two circuit panels and one 1200-hp. Pelton Doble water wheel. All machinery has been purchased. In the near future this plant will supply power to operate the sewerage pump for which a 125-hp. motor has been ordered to be connected to a centrifugal pump. W. L. Frazee is superintendent.

PANAMA—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Oct. 14 for furnishing metalographic outfit, motor-driven grinding machine, boiler equipment, plate bending roll, brass, copper, wire, steel, shafts, motors, etc. For further information address Major Earl I. Brown, general purchasing officer.

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Oct. 14, for furnishing steel channels, sheet brass, bar copper, copper wire, cable thimbles, turnbuckles, plate planer, plate-bending rolls, electric motors, etc. Blanks and general information relating to this circular (No. 1083) may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

1,194,480. SWITCH MECHANISM FOR AUTOMOBILE LIGHTING SYSTEMS; H. A. Clum, Wauwatosa, Wis. App. filed Sept. 29, 1913. Has special dimming mechanism.

1,197,273. ELECTRICAL SIGNALING SYSTEM; E. Ehrhardt, Waidmannslust, near Berlin, Germany. App. filed Aug. 4, 1914. Oscillatory elements for controlling telephone system.

1,198,419. MEANS FOR CONTROLLING DANGEROUS GASES IN SUBMARINES AND OTHER CRAFTS; J. M. Clark, Whitestone, N. Y. App. filed March 10, 1916. Catches battery gases and uses them for fuel or expels them.

1,198,449. STORAGE BATTERY; M. R. Hutchison, W. Orange, N. J. App. filed April 25, 1914. Provision for removing electrolyte wheel cell is upright.

1,198,450. SUPPORT FOR SURGICAL NEEDLES; W. E. Jones, Milwaukee, Wis. App. filed Jan. 14, 1916. For removing superfluous hair and blemishes.

1,198,462. MACHINE FOR MARKING BUTTONHOLE FLIES; R. L. Lloyd, of Portsmouth, and R. D. Simpson, Columbus, Ohio. App. filed March 15, 1912. For marking shoe uppers.

1,198,462. COMBINED SHOE-CUTTING PATTERN AND MARKER; R. L. Lloyd and R. D. Simpson, of Portsmouth, and Columbus, Ohio. App. filed May 18, 1914. Enables simultaneous cutting and marking of the part.

1,198,495. SIGNAL ATTACHMENT FOR AUTOMOBILES AND THE LIKE; C. Wende, St. Louis, Mo. App. filed April 30, 1914. Operated by movements of steering wheel, clutch and gear shift.

1,198,500. WIRE TERMINAL; E. C. Wilcox, Meriden, Conn. App. filed Sept. 4, 1915. Screw terminal applied to end of insulated high-tension cable.

1,198,508. REFILLABLE CARTRIDGE FUSE; E. Alexander, Burlingame, Cal. App. filed July 19, 1915. Method of securing fuse strip to end caps.

1,198,517. SIGNAL APPARATUS FOR AUTOMOBILES; F. L. Bixby, State College, New Mexico. App. filed March 13, 1916. Solenoids for swinging semaphores at opposite sides of windshield.

1,198,578. MAGNETIC TOP; G. H. Reimer, Fulton, Ill. App. filed Jan. 19, 1915. Toy snake agitated by magnetic post of top.

1,198,586. ELECTROMAGNETIC RECORDING DEVICE; A. F. Sanborn and R. C. Wilson, Ossining, N. Y. App. filed June 22, 1914. For recording time of passage of trains.

1,198,616. METHOD OF HEATING CARBON ARTICLES IN INDEPENDENT UNITS; J. W. Brown, Lakewood, Ohio. App. filed June 6, 1912. Polymerizing carbon.

1,198,619. DRY CELL; W. R. Clymer, Cleveland, Ohio. App. filed Dec. 9, 1912. Method of quickly impregnating the tamped mix with electrolytic solution.

1,198,625. ELECTRIC FURNACE; J. L. Dixon, Detroit, Mich. App. filed Feb. 23, 1915. Current can be passed over or through the bath.

1,198,626. STEEL FURNACE; J. L. Dixon, Detroit, Mich. App. filed July 15, 1916. Control of phase relation of transformers.

1,198,659. TROLLEY; C. O. Reardon, Oakland, Cal. App. filed Nov. 22, 1915. Revolvable harp construction.

1,198,671. AUTOMOBILE SIGNAL; E. T. Sherman, Denver, Col. App. filed April 12, 1915. Signals can be combined to indicate different intentions.

1,198,674. ELECTRICAL CONNECTOR; H. S. Sines, Chicago, Ill. App. filed Feb. 23, 1915. Flanged eyelet around which wire end is looped.

1,198,677. PANEL-BOARD WITH SWITCH; H. F. Starrett, Chicago, Ill. App. filed June 13, 1911. Snap switches removably mounted on face of panel-board.

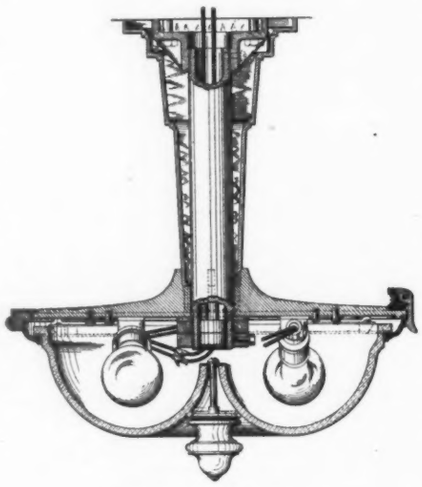
Record of Electrical Patents

Notes on United States Patents issued Sept. 19, 1916, prepared by Mitchell & Allyn, 41 Park Row, New York.

1,198,688. COLLAPSED TIRE ALARM; G. F. Young, Indianapolis, Ind. App. filed Nov. 25, 1914. Contact plunger operated by flattened tire.

1,198,695. MOTOR TO CONTROL AUTOMATICALLY A SUBSCRIBER'S TELEPHONE FOR VARIED SERVICE; E. V. M. Brennan, Philadelphia, Pa. App. filed Oct. 5, 1915. For registering and recording calls, etc.

1,198,699. CONTROL DEVICE FOR WIRELESS SIGNALING; E. H. Colpitts, East Orange, N. J. App. filed Sept. 11, 1915. Reduces power consumption and retains maximum output from apparatus.



1,198,828. Light Fixture

1,198,700. CONTROL DEVICE FOR WIRELESS SIGNALING; E. H. Colpitts, East Orange, N. J. App. filed Sept. 16, 1915. Control of large current from thermionic amplifier.

1,198,703. PROCESS FOR OBTAINING ADHESIVE COATINGS OF COPPER UPON IRON AND STEEL; S. O. Cowper-Coles, London, Eng. App. filed Aug. 24, 1914. Emersion in nitric acid and electrolytic deposition of copper.

1,198,732. PLUNGER FOR FORMING INSULATORS; L. P. Locke, Victor, N. Y. App. filed Aug. 11, 1913. For formation of threads and interior petticoats of insulators.

1,198,734. ELECTRIC LANTERN; E. Ludescher, Chicago, Ill. App. filed March 22, 1916. Carriage or other lantern having a plurality of reflectors.

1,198,735. MOTOR; F. Lux, Waterbury, Conn. App filed Dec. 29, 1913. Pendulum device for mechanical display devices.

1,198,736. ELECTRIC SWITCH; J. F. McElroy, Albany, N. Y. App. filed Aug. 11, 1911. Spring controlled switch arm.

1,198,765. TELEPHONE ATTACHMENT; W. W. Rainwater, Crews, Tex. App. filed Oct. 29, 1914. Eliminates waste of battery current and prevents interference.

1,198,776. APPARATUS FOR PRODUCING OSCILLATING CURRENT; J. Schiessler, Baden, Austria-Hungary. App. filed April 20, 1908. Cooling air directed onto incandescent solid resistance.

1,198,794. ELECTRIC SYSTEM; R. Varley, Englewood, N. J. App. filed March 12, 1913. Obtains initial sparks without the usual heavy vibrator coil.

1,198,802. RAILROAD-CROSSING SIGNAL; S. A. Williams, Los Angeles, Cal. App. filed Nov. 11, 1914. Usual crossed signal arms mounted to be automatically operated.

1,198,804. CIRCUIT CLOSER; H. L. Witt and S. Lookman of Pittsburgh, Pa. App. filed Dec. 3, 1915. For drip-pan of refrigerator.

1,198,828. LIGHT FIXTURE; R. M. Dixon, East Orange, N. J. App. filed May 9, 1914. Semi-direct, as for car lighting.

1,198,845. TEMPERATURE ALARM; S. I. Hendrix, Crescent City, Fla. App. filed Aug. 27, 1914. Dial thermometer.

1,198,857. ELECTRIC LIGHTING; J. B. Lee, Savannah, Ga. App. filed March 7, 1910. For producing signs, pictures, etc.

1,198,860. CIRCUIT-CONTROLLER FOR MECHANICALLY-PLAYING INSTRUMENTS; J. H. Lesley and H. M. Enz, Pittsburgh, Pa. App. filed July 19, 1909. Self-playing piano for playing a number of pieces.

1,198,861. CIRCUIT-CONTROLLER; J. H. Lesley and O. T. Schoen, Pittsburgh, Pa. App. filed Dec. 16, 1910. Pre-payment device for automatic piano.

1,198,867. PROCESS FOR ELECTRIC TREATMENT OF CELLULOSE; A. L. C. Nodon, Bordeaux, France. App. filed Feb. 28, 1913. Treats wood, etc., first to saline solution and then to electric current.

1,198,873. COMMUTATOR BRUSH AND METHOD OF MAKING THE SAME; R. L. Seabury, Wellsville, N. Y. App. filed July 27, 1914. Fine metallic strands in carbon block.

1,198,934. ELECTRIC ENGINE; N. J. LeGrande, Goodwin, Ark. App. filed Feb. 20, 1915. Magnets operate on armatures connected to crank shaft.

1,198,962. ELECTRICAL PROTECTIVE DEVICE; I. Rosenblum, Lynn, Mass. App. filed Oct. 19, 1914. Boron or silicon cut-out.

1,198,964. CAR TRUCK; K. Rushton, Philadelphia, Pa. App. filed June 29, 1916. Springs mounted to accommodate themselves to the lateral movement of the bolster.

1,198,970. ELECTRIC LIGHT REGULATOR; L. Sykes and J. H. Nave, Fort Wayne, Ind. App. filed Dec. 18, 1915. Pole construction for controlling resistance coil.

1,198,987. ELECTROLYTIC MANUFACTURE OF CAUSTIC ALKALIS, ETC.; E. A. Ashcroft, London, England. App. filed March 12, 1912. Obtains desired products in pure anhydrous condition.

1,198,988. SIGNALING APPARATUS; E. Auflero, Brooklyn, N. Y. App. filed Aug. 24, 1911. Engaging cam projections on diaphram and motor shaft.

1,199,004. SYSTEM OF MOTOR CONTROL; A. M. Gray, Milwaukee, Wis. App. filed Sept. 24, 1910. For starting motors having rotating member of considerable inertia.

1,199,011. PRINTING TELEGRAPH; C. L. and H. L. Krum, Chicago, Ill. App. filed Jan. 22, 1908. Improved selecting means (55 claims).

1,199,023. ELECTRIC SIGNAL APPARATUS; G. Thompson, Shelby, Ohio. App. filed June 22, 1914. For ringing electric bells at plurality of distributed points.

1,199,039. ELECTRICAL COMPRESSION RESISTANCE UNIT; P. J. Ray, Lakewood, Ohio. App. filed Dec. 2, 1914. Carbon discs subjected to silicate of soda with carbon.